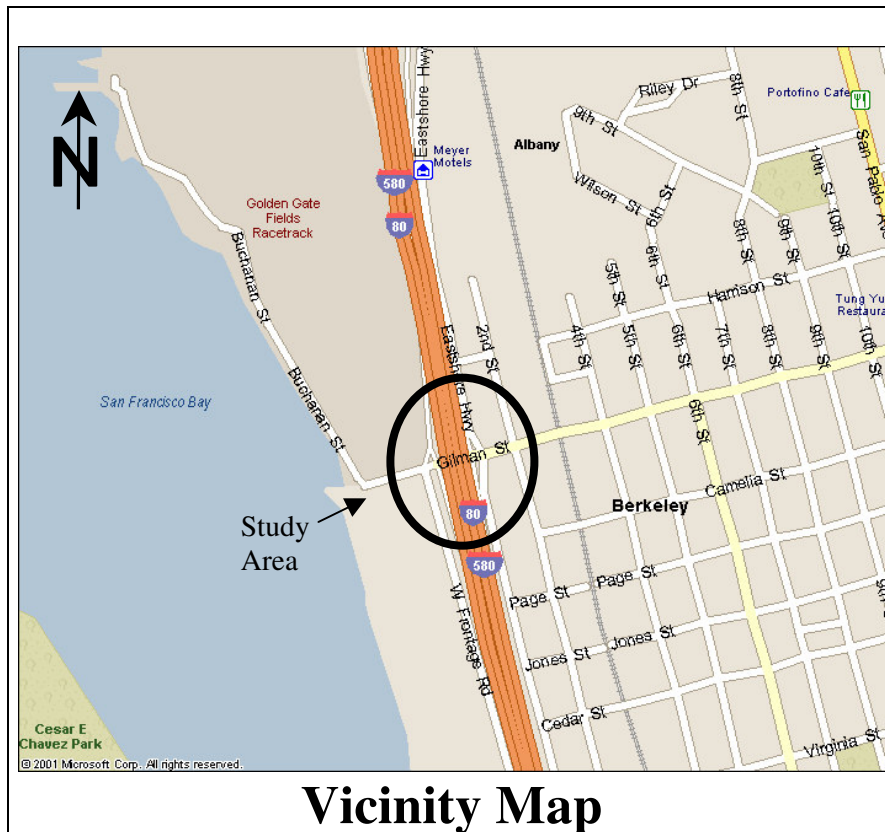


DRAFT PROJECT STUDY REPORT (Project Development Support)

This document can be used to program only the Engineering and Environmental Support for Project Approval. The remaining support and capital components of the project are preliminary estimates and may not be suitable only for programming of the construction phase. The decision regarding the need for a Project Report will be made upon approval of this report by Caltrans.



In Alameda County, On Route 80, in the City of Berkeley at the Gilman Street Interchange with I-80 located at milepost 6.62.

SUBMITTED BY:

Peter Eakland, City of Berkeley

APPROVAL RECOMMENDED BY:


PROJECT MANAGER

APPROVED:

DISTRICT DIRECTOR

DATE

This Project Study Report (Project Development Support) has been prepared under the direction of the following registered civil and traffic engineer. The registered civil engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.


REGISTERED CIVIL ENGINEER
REGISTERED TRAFFIC ENGINEER

11/23/05
DATE



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- Appendix A: Intersection Levels of Service, Existing and Future Base Conditions
- Appendix B: Traffic Model Projections
- Appendix C: Level of Service and Queuing Analysis, Dual Roundabout Alternative
- Appendix D: Level of Service and Queuing Analysis, Two Signalized Intersections
- Appendix E: City of Berkeley Initial Study Checklist

1. Introduction

This Project Study Report (Project Development Support) evaluates proposals to improve operating conditions at the I-80 interchange with Gilman Street located in northwest Berkeley. The project is needed to relieve existing congestion, improve safety, and provide for adequate pedestrian, bicycle, and public transit movements through the interchange study area. Operational improvements at this interchange are the highest priority road project for the City.

The preferred alternative is a dual roundabout configuration that has a roundabout on each side of the interchange with a connecting segment. Not only is it the preferred alternative, it is the only alternative analyzed that could meet the project objectives. A signalized alternative would be unable to meet not only existing but future traffic patterns, and the No Build option would make the existing unacceptable conditions even worse.

The proposed project will be able to maintain the location of existing ramps and frontage rounds and can be constructed without any modifications to structural elements of the freeway overpass or significant right-of-way acquisitions. Roundabout and signalized alternatives were analyzed along with a No Project Alternative, which consists of stop-controlled approaches to Gilman Street. Both the signalized and No Project alternatives were found to be unacceptable not only for long-term but for short-term future

Based on the analysis of existing conditions, all approaches to the dual roundabout should operate at Level of Service C or better when the project is completed. With one exception, they are expected to operate at an acceptable level of service for the entire study period, as long as appropriate strategies are adopted to reduce the volume of freeway bypass traffic utilizing the West Frontage Road.

As more than 80 percent of the funding has been approved, the project should be able to move ahead as fast as State and Federal approvals can be obtained for each step of the programming and approval process. Since the overall cost of the project is only \$1.5 million and has no identified environmental impacts, the project has a high benefit-to-cost ratio.

2. Background

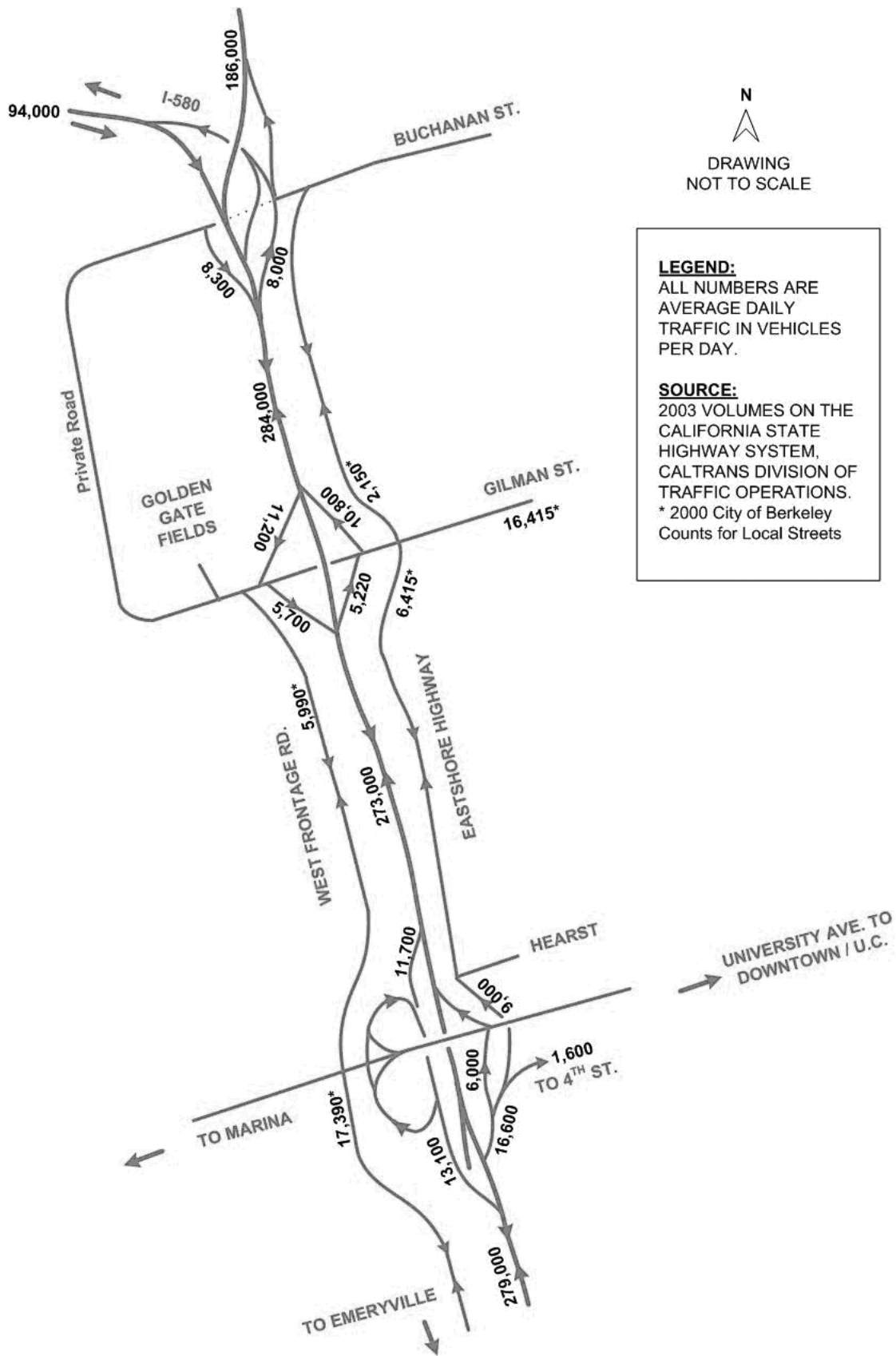
The Gilman Street interchange with Interstate 80 (I-80) is located at milepost 6.62 in the City of Berkeley, County of Alameda, near its boundary with the City of Albany. Currently, a full-diamond interchange provides on and off-ramps for both the eastbound and westbound directions, with stop control for the off-ramps. A two-way frontage road exists on each side of the freeway within close proximity to ramps. On the east side, the frontage road is called Eastshore Highway and extends from the University Avenue interchange on the south to the Buchanan Street interchange on the north. On the west

side, the road is called West Frontage Road. It begins at the Gilman Interchange and extends south to Powell Street in Emeryville with connections to University Avenue and eastbound I-80 near Ashby. As with the off-ramps, the three frontage road approaches currently are controlled with stop signs. Together, the off-ramps and frontage roads create four intersections within a 500 to 600 foot distance in the interchange area, with only 50 feet between the intersections serving the frontage road and the adjacent ramps. No traffic control exists on Gilman Avenue between the traffic signal at 6th Street and its terminus next to the San Francisco Bay shoreline. West of the interchange on Gilman Street, there are two driveways serving Golden Gate Fields. The first serves the stable area, and the second provides access to the main entrance for valet parking and access to the primary parking lot on the north side of the complex. A driveway also serves a parking lot to the south that will soon become recreational ballfields.

Figure 1 displays the Gilman Street interchange in relation to adjacent interchanges together with existing traffic volumes. Operating conditions at the Gilman Street interchange suffer from an incomplete interchange at University Avenue and the use of the frontage roads, particularly the West Frontage Road, as a bypass route during periods of severe congestion on I-80. The University Avenue interchange has neither a northbound to westbound (Marina) nor eastbound to northbound movement. Therefore, a significant number of vehicles utilize the Gilman Street interchange going either to or from the Marina.

Table 1 presents level of service results for I-80 in the vicinity of the Gilman Street interchange based on peak hour travel speeds. The section between University Avenue and I-80/I-580 has consistently been at LOS F since the early 1990's during both the AM and PM peak hours. Similarly, the section to the north has consistently been at LOS F in the westbound direction during the AM peak period and in the eastbound direction during the PM peak period, although during 2004 there were no LOS F conditions observed in this section.

A significant number of vehicles travel on the West Frontage Road during both the AM and PM peak periods to bypass the congestion on I-80 south of Gilman Street. During the AM peak hour, when severe congestion occurs predominately for southbound travel, bypass traffic enters via the westbound off-ramp at Gilman Street from the I-80 westbound off-ramp and can travel as far south as Emeryville before returning to the freeway. During the PM peak hour, when congestion is primarily in the northbound direction, the reverse travel route occurs. In this case, however, the movement has a greater impact on congestion within the interchange as it goes from the West Frontage Road to the I-80 eastbound on-ramp. The volume of peak hour freeway bypass traffic is unlikely to decrease, as no changes currently are being proposed to increase capacity between Central Avenue and the I-80/I-580 split to the Bay Bridge. It may be necessary in the future to implement measures to discourage bypass traffic so that the Gilman Street interchange can operate as efficiently and safely as possible.



North
Not to Scale



Gilman Street Interchange Improvements Figure I - Gilman St Interchange and Adjacent Interchanges

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Table 1
Level of Service Summary for I-80 in the Vicinity of Gilman Street Interchange

I-80 Section	2004 LOS & Travel Speed (mph)				Years with LOS F			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	EB	WB	EB	WB	EB	WB	EB	WB
Central-University	No Data	E (36.7)	D(43.5)	E(40.2)	No Data	97,00-02	91-92, 96-97,02	None
University- I-80 Split	No Data	D(46.7)	F(23.5)	F(20.9)	No Data	97,00	91-95, 97-04	91-92, 94-04

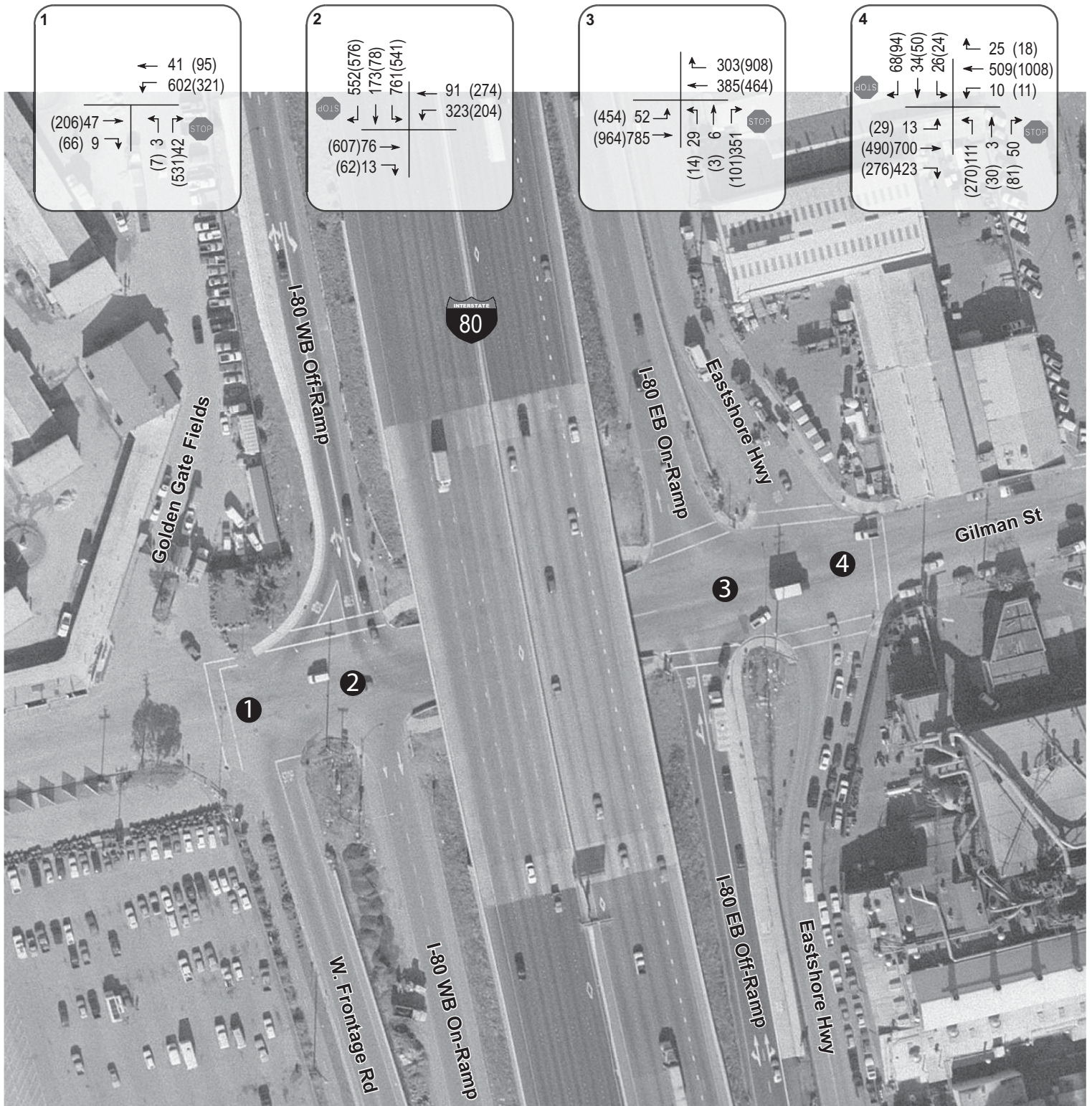
Note: 30 mph has been adopted by Caltrans as the travel speed threshold for Level of Service F.

The issue of bypass traffic represents a significant challenge to the long-term operation of the interchange, regardless of the improvement strategy adopted. Based on existing traffic volumes, bypass traffic in the southbound direction (westbound off-ramp) approaches 50 percent during the AM peak, with 173 through vehicles (westbound off-ramp to westbound on-ramp) and 552 vehicles turning right to go towards the frontage road. A similar percentage exists during the PM peak hour. Bypass traffic in the northbound direction turns right from the West Frontage Road onto Gilman Street and then turns left onto the I-80 eastbound on-ramp. During the PM peak hour, the right turn movement has 530 vehicles, and at least half of these vehicles make the bypass movement. A comparison of recent traffic volumes indicates that the bypass traffic volumes are increasing faster than other traffic volumes.

Current studies and peak hour observations have shown that the stop-controlled ramp intersections with Gilman Street operate at deficient levels of service and will continue to operate with even larger delays in the future. The presence of numerous conflicting movements and extremely close spacing between ramp and frontage road intersections are factors in the excessive number of collisions that occur at the intersections.

The Gilman Street Interchange, besides serving a large number of vehicle movements, plays an important multi-modal role for Berkeley and adjacent communities. The Bay Trail in the Berkeley area is a dedicated Class I bike facility between Gilman Street and Powell Street. Connections to other sections of the trail exist to both the north and the south. Gilman Street is programmed to have bicycle lanes installed and serves as a major connection to the trail from the Berkeley area. The next connection point is approximately one mile to the south at the pedestrian bridge south of the University Avenue interchange.

The Gilman Street interchange until recently was served by AC Transit's transbay Route HX, and it is likely that this route will go back into service with designated funding from



LEGEND

- Study Intersection
- xx A.M. Peak Hour Volume
- (xx) P.M. Peak Hour Volume



Gilman Street Interchange Improvements

Figure 2 - Existing Volumes

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bridge tools. Finally, a multi-use ball field complex will be constructed immediately southwest of the interchange on land purchased by the East Bay Regional Park District from Golden Gate Fields. This recreational project will likely increase pedestrian and bicyclist activity in the area.

The City of Berkeley has been investigating improvement options to control traffic at the interchange for several years. The *Focused Draft EIR, Draft Master Plan, University & Albany/Northwest Berkeley Properties*, August 1997, showed that the Gilman Street/I-80 eastbound off-ramp operated at deficient levels of service during the morning and evening peak hours. It proposed the installation of a traffic signal to mitigate the intersection to an acceptable level of service. However, this analysis did not take into account the effect of the frontage road intersections on the operation of traffic flows within the interchange area. Other substantial traffic signal details such as long clearance intervals and protected left-turn phasing were not taken into consideration in the detailed analyses.

In June 1998, the *Gilman Street/I-80 Interchange Traffic Control Study*, DKS Associates, was completed. It documented a total of 18 options involving roundabouts and traffic signals, with three options recommended for more detailed study. They included a traffic signal and two modern roundabout options. The future traffic volumes for this study were based on traffic growth projections from the Alameda County Congestion Management Agency's (CMA) 2005 travel demand model. Since that time, the CMA traffic model has been updated and now includes Year 2025 projections. The update of the model to 2030 is underway.

3. Need and Purpose

The project has the following objectives: relieve congestion, improve vehicle safety, provide for safe and efficient pedestrian/bicycle movements throughout the interchange study area, and accommodate public transit service. The goal of this study has been to develop at least one alternative that provides an adequate level of service for the next 20 years and can be implemented within relatively short time frame, i.e. 3-5 years.

The four existing study intersections on Gilman Street are controlled by stop signs on the north-south minor street approaches while traffic on Gilman Street is uncontrolled. Traffic volumes were collected on several occasions in 2000 and have been supplemented with traffic counts in 2003 for several major development projects in the area, primarily the University Village project in Albany. The two western intersections with Gilman Street carry approximately 22,300 vehicles per day while the east side serves approximately 32,100 vehicles per day. Existing AM and PM peak hour traffic volumes are shown in.

During the AM peak hour, the most significant traffic movements through the interchange are as follows: (1) westbound I-80 off-ramp to Eastbound Gilman Street; (2) westbound I-80 off-ramp to southbound West Frontage Road, and (3) westbound I-80 off-ramp to southbound Eastshore Highway. Approximately 40 percent of all interchange traffic is from westbound I-80 onto West Frontage Road or Eastshore Highway, indicating a likelihood of freeway-related bypass traffic.

During the PM peak hour, the heaviest traffic movements are as follows: (1) Eastbound Gilman Street to Eastbound I-80 on-ramp; (2) Westbound I-80 off-ramp to eastbound Gilman Street; and (3) northbound West Frontage Road to Eastbound I-80 on-ramp. Approximately 25 percent of all interchange traffic is from West Frontage Road or Eastshore Highway onto the westbound I-80 on-ramp, again indicating a likelihood of freeway-related bypass traffic.

Photos of the study area in Figures 3a-3d provide details of the existing interchange area. Views from both the east side and west side of the interchange show the four sets of columns supporting the I-80 overpass of Gilman Street. The Gilman Street roadway occupies the area between the two center sets of columns. Sidewalks occupy a small portion of the adjacent area between the outer sets of columns.

4. Evaluation Criteria

The operational analysis of alternatives is based in large part on level of service methodologies contained in the *Highway Capacity Manual 2000 (HCM)*, Transportation Research Board, 2000. This source contains methodologies for various types of intersection control, all of which determine the intersection Level of Service (LOS) based on a computed average delay per vehicle in seconds. Table 2 presents the range of average delays for Levels of Service A through F. Generally, LOS A represents free flow conditions, and LOS F represents forced flow or breakdown conditions.

Analysis details for each type of traffic control option are presented below:

- Unsignalized Two-Way Stop Intersections: The analysis focuses on movements that have conflicting movements. In general, critical movements are left and through movements on approaches with stop sign control. In general, the level of service for a Two-Way Stop Intersections is based on the approach with the highest delay. The HCM methodology, as implemented in Synchro, was utilized for this analysis. Only LOS F conditions were considered to represent unacceptable conditions.
- Signalized Intersections: Synchro software was utilized as the analysis tool because of its ability to analyze two closely spaced intersections as a single intersection and to consider the impacts of coordination as well as the impacts of



Fig 3a. Gilman Street westbound, east of Eastshore Highway



Fig. 3b. I-80 Eastbound Ramps, looking north



Fig. 3c. Gilman Street eastbound, west of West Frontage Road



Fig 3d. I-80 Westbound Ramps, looking north

congestion at upstream and downstream intersections. The analysis does not conform exactly to the HCM methodology, but for uncongested conditions the results are largely comparable. Synchro provides results for queuing (95th and 50th percentiles) as well as the level of service for lane groups and the overall intersection. The 95th percentile queues are presented in the tables.

Table 2 Intersection Level of Service Criteria		
Level of Service	Unsignalized Intersections (Two-way Stop)	Signalized Intersections and Roundabouts
A	Delay of 0 to 10 seconds. Gaps in traffic are readily available for drivers exiting the minor street.	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.
B	Delay of 10 to 15 seconds. Gaps in traffic are somewhat less readily available than with LOS A, but no queuing occurs on the minor street.	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
C	Delay of 15 to 25 seconds. Acceptable gaps in traffic are less frequent, and drivers may approach while another vehicle is already waiting to exit the side street.	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
D	Delay of 25 to 35 seconds. There are fewer acceptable gaps in traffic, and drivers may enter a queue of one or two vehicles on the side street.	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
E	Delay of 35 to 50 seconds. Few acceptable gaps in traffic are available, and longer queues may form on the side street.	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.
F	Delay of more than 50 seconds. Drivers may wait for long periods before there is an acceptable gap in traffic for exiting the side streets, creating long queues.	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.
Reference: <i>Highway Capacity Manual 2000</i> , Transportation Research Board, 2000.		

- **Roundabouts:** The HCM contains only a simplistic analysis for standard one-lane roundabout facilities, which is inappropriate for this project. Instead, the aaSIDRA software application was utilized, which is able to analyze complex roundabout designs. It provides level of service results for both the overall facility and approaches as well as queuing estimates for approaches. In assigning level of service, aaSIDRA utilizes the same average delay ranges that have been adopted by the HCM for signalized intersections.

For the purpose of this study, evaluation criteria go beyond overall intersection level of service criteria and focus equally on level of service and vehicle queues for lane groups serving major traffic volumes. The additional evaluation measures are important because of the complex roadway layout and the potential for gridlock conditions within the interchange area. Given the high volume of traffic being handled by roadways and ramps within the study area, Level of Service E is considered to be acceptable, though undesirable. Conditions assumed to be unacceptable include one or more of the following conditions:

1. Level of Service F for an overall intersection or roundabout;
2. Level of Service F for a lane group that handles a significant volume of traffic (more than 100 vph), and
3. Vehicle queues that exceed the available storage capacity on ramps or between intersections.

5. Analysis of Existing Conditions

Level of Service: Existing intersection operations, which all have stop control on the side-street approaches, are summarized in Table 3; and calculation sheets are included in Appendix A. The key variable in the HCM methodology for unsignalized intersections is the duration of the minimum gap that turning movements with conflicting traffic will accept. In highly congested areas, such as the Gilman Street/I-80 interchange, motorists often will accept smaller gaps. As a result, queues seen in the field are often less than those forecast, but this increase in capacity often comes at the price of decreased safety, as described in the following section.

With existing traffic controls and intersection configurations all stop-controlled movements, except at the West Frontage Road intersection, experience LOS F conditions during one or both peak hours. Clearly, the stop-controlled approaches are unable to safely handle any additional traffic.

All LOS F conditions except one have estimated delays of more than 180 sec., which is more than three times the threshold for this level of service. Two approaches have LOS F conditions in both peak hours: the southbound I-80 off-ramp approach and the northbound Eastshore Highway approach. The only movement at LOS F on Gilman Street is the eastbound left turn onto the I-80 eastbound on-ramp during the PM peak hour, when this is a significant volume of conflicting traffic.

Table 3
Existing Weekday Peak Hour Level of Service Conditions
(Existing Stop Control on Side Street Approaches)

Intersection and Approach	Level of Service and Approach Delay in sec.	
	Existing (2003)	
	AM Peak	PM Peak
1. Gilman St/West Frontage Rd		
<i>Northbound Approach</i>	<i>B (11.3)</i>	<i>C (16.7)</i>
2. Gilman St/I-80 WB Ramps		
<i>Southbound Approach</i>	<u>F (>180)</u>	<u>F (>180)</u>
3. Gilman St/I-80 EB Ramps		
<i>Northbound Approach</i>	<i>C (21.0)</i>	<u>F (>180)</u>
<i>Eastbound Left</i>	<i>A (2.1)</i>	<u>F (64.6)</u>
4. Gilman St/Eastshore Hwy		
<i>Northbound Approach</i>	<u>F (>180)</u>	<u>F (>180)</u>
<i>Southbound Approach</i>	<i>E (39.1)</i>	<u>F (>180)</u>

Note: Analysis based on two-way stop procedures in 2000 Highway Capacity Manual.

Level of Service F conditions are bold-faced and underlined.

Safety: Based on information provided by the City of Berkeley staff, there were 101 reported collisions at the four subject intersections for the years 1994 to 2000, or an average of 14.4 collisions per year. As shown in Table 4, this translates to collision rates of 0.76, 0.33, 0.25 and 0.63 collisions per million vehicles entering (c/mve) the four study intersections from west to east respectively. The calculation of collision rates assumes that the two intersections on each side of the interchange are treated as single intersections. The combined intersection of I-80 westbound ramps and the West Frontage Road intersection with Gilman Street has experienced a collision rate of 0.74 collisions per million vehicles entering the intersection (c/mve), and the combined intersection of I-80 eastbound ramps and Eastshore Highway has recorded a similar rate of 0.72 c/mve. The average collision rate for four-way intersections in urban areas with stop control on the side streets is less than one-third these rates at 0.22 c/mve, based on information provided in *Caltrans 2002 Accident Data on California State Highways*. The Gilman Street intersections are not strictly comparable to the four-way intersections in the Caltrans data, but nevertheless the average can be used to create a representative comparison. It can reasonably be concluded that the intersections at the Gilman Street

interchange have experienced a collision history significantly higher than that at standard four-way intersections in urban areas with stop-controlled side streets.

Table 4
Collision Rates – Existing Conditions ⁽¹⁾

Measure	Gilman Street – West Side			Gilman Street - East Side		
	Gilman/ W. Frontage	Gilman/ I-80 WB	Combined	Gilman/ I-80 EB	Gilman/ Eastshore	Combined
Collisions/year	3.43	2.57	6.0	2.71	5.71	8.43
Peak Hour Volume	1,232	2,136	2,228	3,023	2,480	3,214
Daily Volume	12,320	21,360	22,280	30,230	24,800	32,140
Yearly Volume (mv) ⁽²⁾	4.50	7.80	8.13	11.03	9.05	11.73
Collision Rate ⁽³⁾	0.76	0.33	0.74	0.25	0.63	0.72
Expected Rate ⁽⁴⁾	0.22	0.22	0.22	0.22	0.22	0.22

Notes: (1) Collisions reported 1/1/94 to 12/31/00; (2) mv = million vehicles; (3) collisions per million vehicles entering; (4) Source: Caltrans 2002 Accident Data on California State Highways.

Pedestrian/Bike Access: The Bay Trail is a planned recreational corridor that, when complete, will encircle the San Francisco and San Pablo Bays with a continuous 400-mile network of bicycling and hiking trails. It offers access to commercial, industrial and residential neighborhoods; points of historic, natural and cultural interest; recreational areas like beaches, marinas, fishing piers, boat launches, and over 130 parks and wildlife preserves totaling 57,000 acres of open space. Also, it provides easily accessible recreational opportunities for outdoor enthusiasts, including hikers, joggers, bicyclists and skaters. It also offers a setting for wildlife viewing and environmental education, and increases public respect and appreciation for the Bay. Further, it has important transportation benefits, providing a commute alternative for cyclists, and a connection to numerous public transportation facilities (including ferry terminals, light-rail lines, bus stops and Caltrain, Amtrak, and BART stations). Eventually, it will cross all the major toll bridges in the Bay Area.

In the study area, an existing Bay Trail segment extends from Gilman Street south to Powell Street in Emeryville. There are planned trail extensions that would continue the trail south of Powell Street and north around the bay side of Golden Gate Fields. Gilman Street, which is designated in the City's Bicycle Plan as a bike route and is programmed to have bike lanes as far east as San Pablo Avenue, serves as a primary bike access route to the Bay Trail for residential neighborhoods to the east.

Currently, a separated pedestrian/bicycle path exists between the freeway ramps on both the north and south sides of Gilman Street. On the north side, there are crosswalks at each road or ramp. On the south side, crosswalks exist except at the eastbound on-ramp and the westbound on-ramp. The construction of new playing fields on the south side of Gilman Street west of the West Frontage Road likely will increase pedestrian movements through the interchange area.

Public Transit Service: The Gilman Street interchange has had an inbound and outbound bus stop for the HX Bay Bridge express bus route. Although the route was discontinued as part of a recent service reduction, it likely will be reinstituted with funds from a voter increase in Bay Area bridge tolls designed to provide multi-modal improvements. For this service, a stopping area is available on the eastbound off-ramp and on the westbound on-ramp. Any alternatives need to provide for transit stops in appropriate locations.

If Gilman Street is selected as a terminal for ferry service from the Berkeley area, feeder buses will be included as part of the project. The choice likely will be between a terminal in the Berkeley Marina area with access from University Avenue and Gilman Street, although several options also exist on the north side of Golden Gate Fields in Albany. At this time, the selection process for terminals is at an early stage.

6. Future Traffic Projections

The development of this report has been underway for several years, and the future analysis year of 2005, which was initially approved by Caltrans has been retained. Since no relevant forecasting models currently exist that provide countywide 2030 forecasts, it would have been necessary to extrapolate from the 2025 volumes. The results in all cases would have been values somewhat larger than those for 2025. Given the large uncertainty regarding the forecasts for the freeway bypass traffic, which could utilize a significant percentage of available capacity, it was felt that extending the timeline would not provide any additional insights into the feasibility of the project.

The analysis utilized the most recent forecast detailed traffic report based on the 2025 forecasts from the Alameda County traffic forecasting model, which was the *Transportation Impact Analysis for the University Village & Albany/Northwest Berkeley Properties Master Plan Amendments*, Fehr & Peers, January 2004. First, 2025 baseline traffic volumes were generated by adding net growth to existing link volumes and then balancing the turning movements. Finally, project volumes from an expanded University Village project as well as the Target store on Eastshore Highway and proposed recreational ballfields were added. Traffic volumes are anticipated to increase by approximately 33 percent. The two western intersections with Gilman Street would be expected to experience an increase from 22,300 vehicles per day to approximately 32,200 vehicles per day. Volumes on the east side would be expected to increase from 32,100 vehicles per day to approximately 40,300 vehicles per day. The original forecasts from

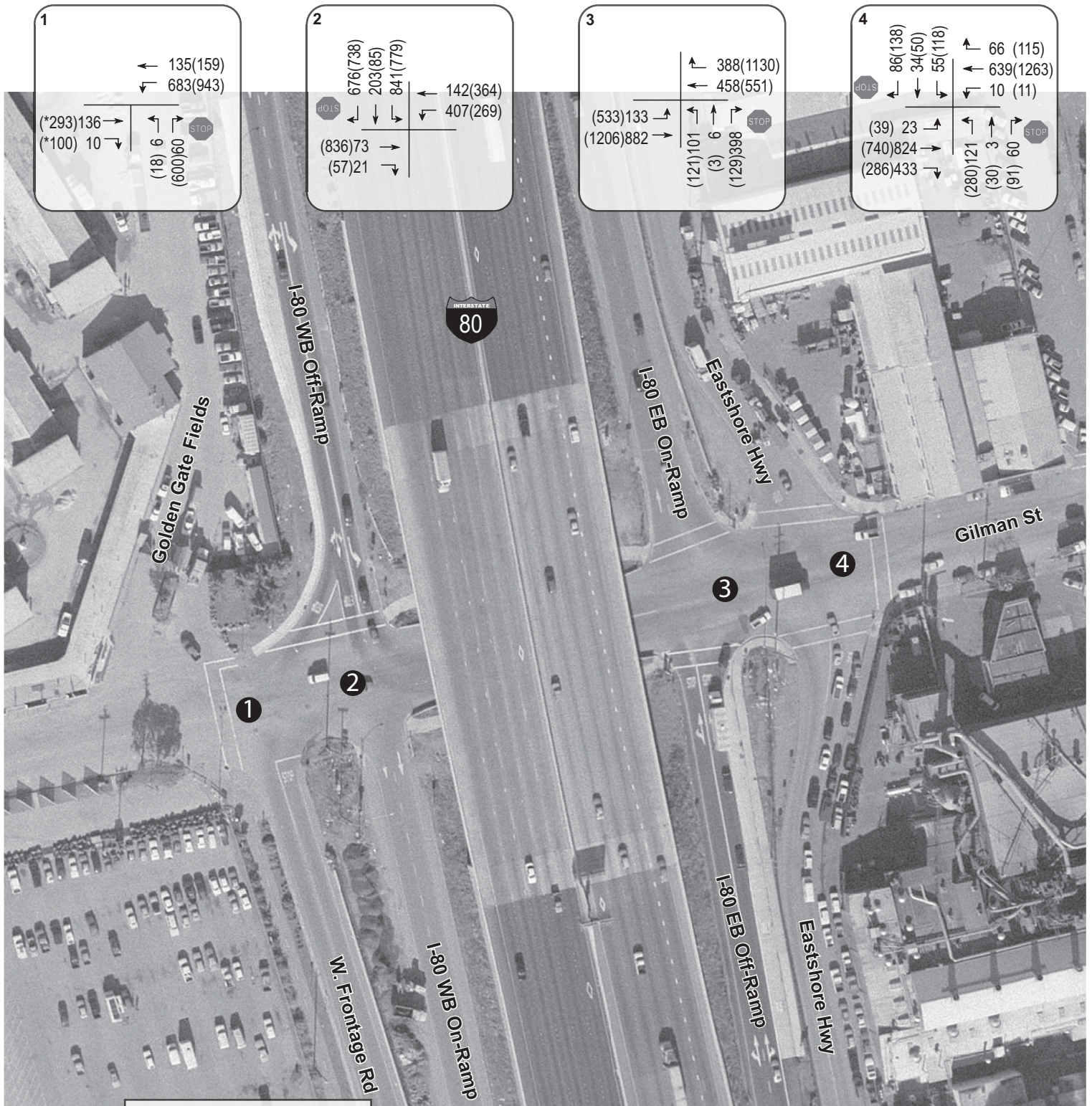
the Alameda County model are provided in Attachment B.

Adjustments in the forecasts were made to account for two issues, as follows:

1. Revised land use assumptions for the land west of the freeway that is accessed by Gilman Street. Until recently, the General Plan called for retail and possibly a hotel. Instead, the land to the south will be utilized for recreational ballfields, which will generate considerably less traffic. Also, in recent years, the daytime traffic for Golden Gate Fields has decreased because of the popularity of off-track betting and races are scheduled to avoid peak hour traffic; and improvements to the Buchanan Street interchange in Albany has made it the primary access and egress road for the facility. The decision was made to reduce baseline future year traffic forecasts for movements to and from Gilman Street west of the interchange to existing volumes. The reductions were applied to all future year scenarios.
2. Impact of Freeway Bypass Traffic traveling on the West Frontage Road. The tendency for freeway bypass traffic to utilize available capacity at the interchange suggests that some form of traffic metering on the West Frontage Road may be necessary. The Alameda County traffic model indicates a substantial growth in traffic diverting from Interstate 80 onto West Frontage Road between the Gilman Street and Ashby Avenue freeway interchanges. The growth is attributable to a lack of capacity on Interstate 80 and reflects current driver behavior during extreme congestion periods on the freeway. The two movements that make up this traffic are as follows: (1) westbound I-80 off-ramp to southbound West Frontage Road in both the AM and PM peak hours, and (2) northbound West Frontage Road to eastbound I-80 on-ramp only in the PM peak hour. Even if metering strategies are not adopted, large delays for bypass traffic likely would result in this traffic seeking other routes, including a return to the freeway.

Analyses were made both with and without adjustments in order to assess the need for and impact of diversion strategies. The strategies likely would include metering at the northbound West Frontage Road approach at Gilman Street and at the southbound approach at University Avenue. Based on initial analyses of future conditions, a 25 percent diversion figure was selected for the freeway bypass traffic. It is important to note that this reduction would not eliminate all bypass traffic, as it is only one-half of this current traffic.

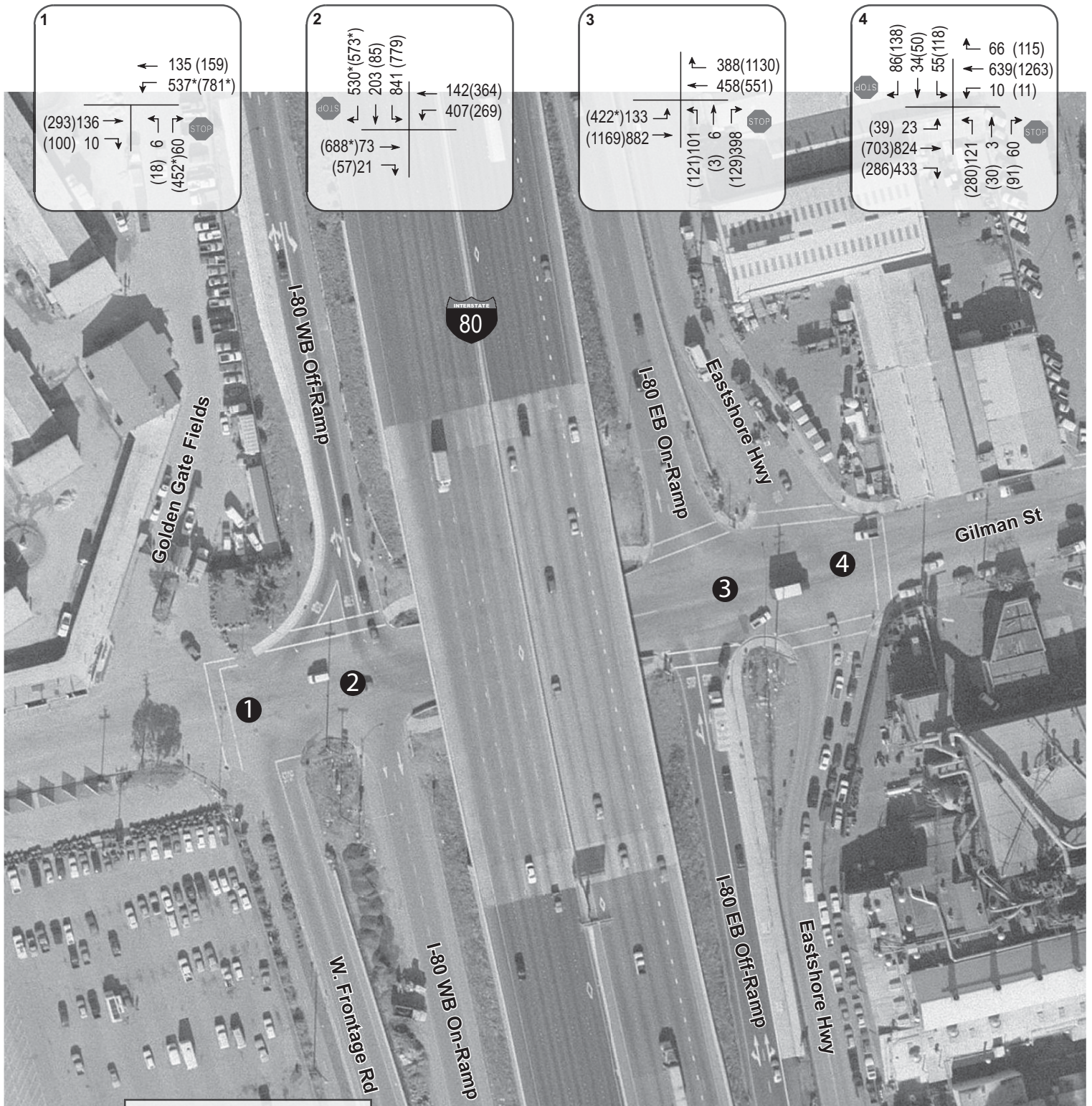
Traffic forecasts without capacity constraint are presented in Table 4A, and those with a 25 percent diversion of freeway bypass traffic are presented in Table 4B.



Gilman Street Interchange Improvements Figure 4A - Future Volumes

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LEGEND

- Study Intersection
- xx A.M. Peak Hour Volume
- (xx) P.M. Peak Hour Volume
- * Volumes adjusted to reflect reduction in freeway bypass traffic



Gilman Street Interchange Improvements

Figure 4B - Future Volumes (with diversion)

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7. Future Year Operational Analyses of Alternatives

No Project: Existing Geometry (2-way stop control)

The future Year 2025 intersection operations for base (two-way stop control) conditions are summarized in Table 5. By any measure, the existing geometry is unable to handle the additional traffic volume to be added to the interchange by 2025, even with measures to limit the volume of traffic bypassing highway congestion. As expected, the delays would significantly increase for conditions. In the PM peak hour, even with adjusted volumes, all of the stop-controlled approaches would be at LOS F as well as eastbound left turns onto the I-80 eastbound on-ramp. In the AM peak hour for both unadjusted and adjusted conditions, LOS F conditions would exist on all of the stop-controlled approaches except for the northbound approach at the West Frontage Road. Without any improvements, the Gilman interchange would be incapable of accommodating any additional traffic from the streets feeding into the interchange. Also, the intersections would continue to experience more collisions than at standard four-way intersections in urban areas with stop-controlled side streets.

Table 5
No Project Conditions: Weekday Peak Hour Level of Service

Intersection	Level of Service and Approach Delay in sec.					
	Existing (2003)		Future (2025)		Future (2025 Adj.)	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
1. Gilman St/West Frontage Rd <i>Northbound Approach</i>	<i>B (11.3)</i>	<i>C (16.7)</i>	<i>C (>17.2)</i>	<u>F (>180)</u>	<i>B (12.9)</i>	<u>F (>180)</u>
2. Gilman St/I-80 WB Ramps <i>Southbound Approach</i>	<u>F (>180)</u>	<u>F (>180)</u>	<u>F (>180)</u>	<u>F (>180)</u>	<u>F (>180)</u>	<u>F (>180)</u>
3. Gilman St/I-80 EB Ramps <i>Northbound Approach</i>	<i>C (21.0)</i>	<u>F (>180)</u>	<u>F (81.2)</u>	<u>F (>180)</u>	<u>F (81.2)</u>	<u>F (>180)</u>
<i>Eastbound Left</i>	<i>A (2.1)</i>	<u>F (64.6)</u>	<i>A (2.1)</i>	<u>F (>180)</u>	<i>A (2.1)</i>	<u>F (>156)</u>
4. Gilman St/Eastshore Hwy <i>Northbound Approach</i>	<u>F (>180)</u>	<u>F (>180)</u>	<u>F (>180)</u>	<u>F (>180)</u>	<u>F (>180)</u>	<u>F (>180)</u>
<i>Southbound Approach</i>	<i>E(39.1)</i>	<u>F (>180)</u>	<u>F (128)</u>	<u>F (>180)</u>	<u>F (128)</u>	<u>F (>180)</u>

Note: Results are shown as Level of Service (A-F) with average vehicle delay on critical approaches in seconds.

Level of Service F conditions are bold-faced and underlined.

Roundabout Alternatives (Alternatives A-1 and A-2)

The City of Berkeley desires to retain existing traffic movements on both the east (Eastshore Highway) and west frontage roads. Consequently, the City has indicated a desire to examine the feasibility of roundabouts as an alternative to traffic signals. Roundabouts have the ability to serve multiple street approaches with minimal queuing, reduce the number of vehicle conflicts and serious collisions, and reduce travel speeds, while being able to continue to provide safe and efficient pedestrian and bicycle movements on the corridor. Through initial discussions with Caltrans staff, two roundabout alternatives were developed. The dual roundabout alternative (A-1) has a separate roundabout serving each side of the interchange, and the oval roundabout alternative (A-2) has a single roundabout serving all entry and exit points within the interchange area.

The number of modern roundabouts being installed in the United States is increasing rapidly. Modern roundabouts are precisely designed facilities that have capacities equal to or greater than traffic signals and provide additional advantages. Following is a list of “pros and cons” associated with roundabouts, compiled from several sources including the Federal Highway Administration (FHWA) publication *Roundabouts: An Informational Guide*, dated June, 2000.

Advantages

Vehicle Safety

- Roundabouts have 75 percent fewer vehicle “conflict points,” or locations where vehicles cross paths, than conventional intersections.
- The Insurance Institute for Highway Safety analyzed before-and-after safety conditions at existing intersections that have been converted to roundabouts. The results indicate a 39 percent decrease in total crashes, a 76 percent decrease in injury-producing crashes, and a 90 percent decrease in fatal crashes.
- Some of the most serious types of collisions, including head-on and broadside, cannot occur at roundabouts.

Pedestrian Safety

- Pedestrians only have to cross one single-lane direction of traffic at a time, and have considerably less exposure to vehicles than at conventional intersections.
- The conversion of existing intersections to roundabout-controlled intersections has been found to decrease the number and severity of pedestrian accidents (by as much as 73 percent according to a Dutch study).

Traffic Operation

- For a given approach width, roundabouts are capable of handling a higher volume of vehicles than other types of intersection controls.
- Roundabouts can often have lower average vehicle delays and better Levels of Service than conventional intersections.

- The ability to make U-turns is relatively easy and safe at roundabout-controlled intersections.
- Roundabouts regulate vehicle speeds because of yield control at access points.

Environment and Aesthetics

- By reducing the amount of rapid acceleration and deceleration associated with other types of intersection controls, as well as idling, roundabouts typically cause vehicles to consume less fuel and correspondingly lead to lower vehicle emissions.
- Roundabouts provide an excellent opportunity for landscaping and/or public art, and most people find them more attractive than traffic signals.

Disadvantages

Safety for Visually Impaired Persons

- Roundabouts do not have the same audible queues used by visually-impaired pedestrians to cross stop-controlled and signalized intersections, and may require special design treatments to accommodate these users.

Initial Confusion and Driver Unfamiliarity

- Drivers who are unfamiliar with roundabouts may become timid or uncertain upon approach to the intersection, and may violate yield controls or stop at inappropriate times, potentially resulting in minor accidents.

Potential Increase in Minor Collisions

- Though roundabouts typically result in an overall decrease in collisions and a substantial decrease in serious collisions, they may result in an increased frequency of minor collisions such as rear-end and low-speed sideswipes.

Inappropriate Locations

- Roundabouts should not be located at intersections with sight distance constraints or locations where adequate space is unavailable.
- Adequate space may not be available to provide for the movement of long trucks.
- Single-lane roundabouts generally should not be used in locations with entering flows exceeding 2,400 to 2,800 vehicles per hour.

Advantages/Disadvantages

Public Acceptance of Roundabouts

- In the United States, it has been found that many communities experience public opposition to roundabouts in the early planning stages. After construction and some time to acclimate, however, public opinion typically shifts to a much more positive viewpoint.

Impacts to Bicyclists

- Studies of bicycle safety at roundabouts have yielded mixed results. Roundabout design must consider the degree of anticipated bicycle activity and incorporate

design elements that protect bicyclist safety. Faster/more confident bicyclists can proceed through the roundabout as a vehicle, while slower/less confident riders can bypass the roundabout by utilizing the crosswalks on the entries and exits and the off-street paths.

- Many bicyclists prefer roundabouts to traffic signals because they are not required to stop, and because vehicle speeds are decreased to near bicycle speeds at the intersection itself.

Parking

- The space consumed by roundabouts sometimes results in lost parking spaces adjacent to an intersection. This configuration can have a positive effect on parking supply just beyond roundabout intersections, however, as the removal of turn lanes and/or through lanes may create more available street width for on-street parking.

Caltrans recognizes the FHWA guidelines as the primary source of technical guidance for the evaluation and development of roundabout proposals. In the cover memorandum to its design bulletin on roundabouts issued in October 3, 2003, Caltrans states that “The modern roundabout is now recognized nationally as an intersection type and traffic control treatment capable of providing unique and significant operational and safety benefits over a wide range of traffic volumes and conditions.”

Table 6 presents the entering volumes for existing and future traffic scenarios. Based on the FHWA guidelines, a single lane roundabout would not be adequate for roundabouts on each side of the interchange, even for existing conditions.

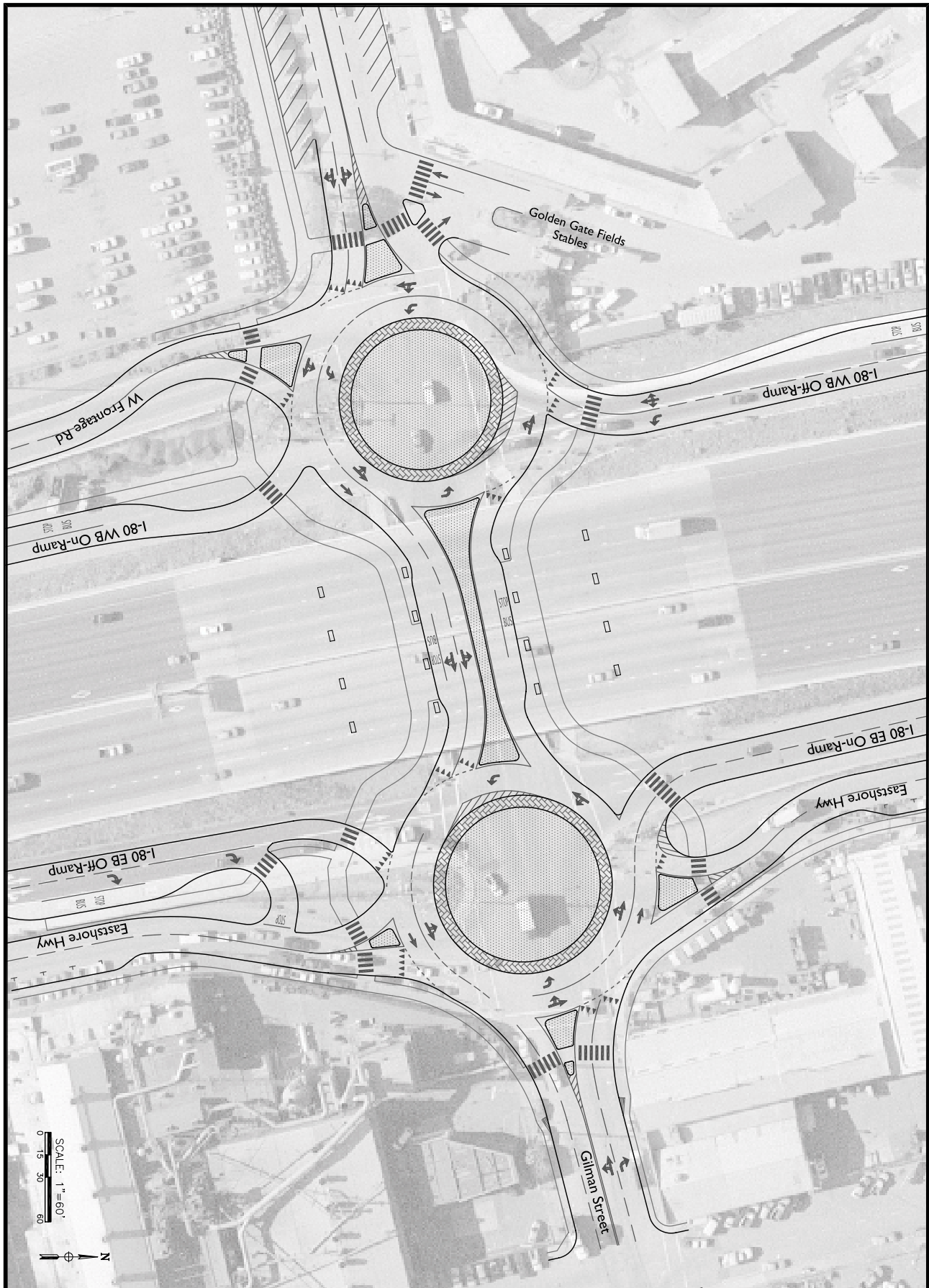
Table 6
Entering Vehicles by Traffic Scenario

Traffic Scenario	West Roundabout		East Roundabout	
	AM Peak	PM Peak	AM Peak	PM Peak
Existing Conditions	2,227	2,615	2,275	3,289 ⁽¹⁾
Future (2025)	2,760	3,416 ⁽¹⁾	2,733	4,303 ⁽¹⁾
Future (2025 adj.)	2,598	3,090 ⁽¹⁾	2,733	4,147 ⁽¹⁾

Note: (1) = exceeds maximum value guideline of 2,800 vph for single-lane roundabout.

Alternative A-1 – Dual Roundabout

This alternative includes a roundabout on each side of I-80 with a connecting section (Figure 5). The western intersection would serve the I-80 westbound off-ramp, the I-80



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IN: ZW
NO. 08004
SHEET 1 OF 1

GILMAN INTERCHANGE ROUNDABOUT CONCEPT
CITY OF BERKELEY

**FIGURE 5 - DUAL ROUNDABOUT OPTION
(ALTERNATIVE A-1)**



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westbound on-ramp, Gilman Street, and the West Frontage Road. The eastern intersection would serve the I-80 eastbound off-ramp, I-80 eastbound on-ramp, Gilman Street and Eastshore Highway approaches.

As a single-lane roundabout is unable to accommodate future volumes at either roundabout, an iterative approach was used to establish sections of the roundabouts where two lanes would be required. Developed in Australia, it has undergone extensive testing and is considered to be a state-of-the-art analysis tool for roundabout design. Delay is calculated for each approach and for the roundabout overall, and is primarily based on the availability of gaps in circulating traffic and geometric factors such as the diameter of the roundabout and number of entering and circulating lanes. Roundabout Level of Service is then determined based upon the same delay ranges established in the HCM. It should be noted that the RODEL software application was also utilized during the design process. RODEL is a valuable design tool based on empirical research that relies on specific geometric criteria such as entry radii, roadway widths, flare lengths, and diameter. The resulting design was utilized for analysis for all traffic scenarios. Creation of the final layout included refinements to ensure the movement of large trucks and to minimize right-of-way acquisitions. Also considered was compatibility with the ballfields project located southwest of the interchange that has been approved for construction.

The roundabout option in Figure 5 has the following characteristics:

- The internal layout of the roundabouts is a combination of two-lane and one-lanes that provides adequate capacity while eliminating the need for any traffic to change lanes. Thus, no weaving will occur that would reduce the capacity of the roundabout.
- The I-80 eastbound off-ramp contains a bypass lane for traffic turning right onto the Eastshore Highway. This lane reduces the volume of traffic that has to enter the eastern roundabout and provides a large turning radius so that larger vehicles to make this movement.
- The western roundabout has two, dual-lane approaches, the I-80 westbound off-ramp, and Gilman Street westbound. It has two lanes for three-fourths of the circle from the I-80 off-ramp to the exit for the connecting road.
- The eastern roundabout also has dual-lane approaches for both Gilman Street westbound and connecting road eastbound traffic. Two, dual-lane exits are also provided at the I-80 eastbound on-ramp and at the Gilman Street eastbound exit. Similar to the westbound roundabout, this roundabout has two lanes for three-fourths of the circle from the connecting road entry counter clock-wise to the I-80 eastbound on-ramp.

- The eastbound segment connecting the two roundabouts would have two lanes while the westbound segment would have a single lane.
- Pedestrian/bike paths would be created around the perimeter of the two roundabout systems with standard roundabout pedestrian crossings at the “splitter” island locations. The paths on the northern and southern sections would be provided between the outer columns and the retaining wall. No pedestrian/bicycle access would be provided in the interior of the two roundabouts although bicycles are able to legally travel through them.
- Public transit features include bus stops on the two I-80 ramps that would serve freeway flyer trips to and from the Bay Bridge – the eastbound on-ramp and the westbound off-ramp. Also, stops are provided on each side of the connecting section that can serve local buses serving the area and turning around at the western end of Gilman Street.

The operational analysis focused on three performance measures as follows: the overall level of service for each roundabout, levels of service for each entry approach, and the vehicle queue for each entry approach. Table 7 contains the level of service results for existing conditions as well as future (2025) traffic volumes with and without adjustments, and queues are presented in Table 8. Also, the performance measures are shown pictorially in Figures 6a-6c. The aaSIDRA calculation sheets are contained in Appendix C.

For existing conditions, all approaches would operate at LOS C or better with the dual roundabout option. In fact, the only LOS C approach would be the northbound West Frontage Road in the PM peak period. The analysis of existing conditions was included so that, when compared with future conditions, an assessment could be made of the operational life of the alternative.

For the future unadjusted scenario, two approaches would be at LOS F in the PM peak period, the northbound approach at the West Frontage Road and the southbound approach at the Eastshore Highway; and another, the eastbound Gilman Street approach to the eastern roundabout, would be at LOS E. Queuing would exceed 30 vehicles on the LOS F two approaches, and an additional two approaches would have queues exceeding 20 vehicles. Also, the queue for the Gilman Street eastbound entry to the eastern roundabout would occasionally exceed the length of the connecting segment.

The critical movement for this traffic scenario is the freeway bypass traffic going from the northbound West Frontage Road to the eastbound I-80 on-ramp. The northbound approach at the West Frontage Road, because of this traffic, would have an average delay of 256 seconds, which is three times the LOS F threshold, and a queue of almost 2,200 ft. Also, it contributes to congestion on both roundabouts, as its vehicles travel the last one-quarter of the western roundabout, the connecting section, and three-quarters of the east roundabout.

Table 7
Intersection LOS Conditions with Dual Roundabout

Intersection and Approach	Existing (Avg. Delay-LOS)		Future (2025) (Avg. Delay-LOS)		Future Adj. (2025) (Avg. Delay-LOS)	
	AM	PM	AM	PM	AM	PM
1. Western Roundabout	11.0-B	11.7-B	21.9-C	68.6-E	16.4-B	25.2-C
<i>Northbound W. Frontage Rd</i>	<i>10.3-B</i>	<i>21.2-C</i>	<i>17.2-B</i>	<u><i>255.7-F</i></u>	<i>15.1-B</i>	<i>69.4-E</i>
<i>Southbound I-80 off-ramp</i>	<i>11.5-B</i>	<i>9.2-A</i>	<i>24.8-C</i>	<i>20.3-C</i>	<i>18.7-B</i>	<i>16.7-B</i>
<i>Eastbound Gilman Street</i>	<i>14.6-B</i>	<i>10.9-B</i>	<i>40.8-D</i>	<i>69.4-E</i>	<i>22.8-C</i>	<i>32.1-C</i>
<i>Westbound Gilman Street</i>	<i>8.7-A</i>	<i>7.6-A</i>	<i>8.2-A</i>	<i>7.3-A</i>	<i>8.2-A</i>	<i>7.3-A</i>
2. Eastern Roundabout	3.9-A	6.7-A	5.5-A	42.3-D	5.5-A	21.3-C
<i>Northbound I-80 off-ramp</i>	<i>6.7-A</i>	<i>7.6-A</i>	<i>10.9-B</i>	<i>16.6-B</i>	<i>10.9-B</i>	<i>15.6-B</i>
<i>Northbound Eastshore Hwy</i>	<i>7.7-A</i>	<i>8.8-A</i>	<i>9.5-A</i>	<i>13.3-B</i>	<i>9.5-A</i>	<i>12.3-B</i>
<i>Southbound Eastshore Hwy</i>	<i>7.0-A</i>	<i>16.1-B</i>	<i>8.4-A</i>	<u><i>339.7-F</i></u>	<i>8.4-A</i>	<u><i>134.9-F</i></u>
<i>Eastbound Gilman Street</i>	<i>2.1-A</i>	<i>4.4-A</i>	<i>2.9-A</i>	<i>4.6-A</i>	<i>2.9-A</i>	<i>4.5-A</i>
<i>Westbound Gilman Street</i>	<i>2.7-A</i>	<i>7.6-A</i>	<i>3.7-A</i>	<i>37.0-D</i>	<i>3.7-A</i>	<i>19.2-B</i>

Notes:

Delay = average seconds of delay per vehicle; LOS = Level of Service (A-F).

Levels of Service F have been underlined.

Future Adjusted = 2025 scenario with volume reductions to account for metering on northbound West Frontage Road at Gilman Street and southbound West Frontage Road at University Avenue.

Table 8
Queue Lengths with Dual Roundabout⁽¹⁾

Intersection Approach	Available Distance (ft.)	Existing ft. (veh.)		Future (2025) ft. (veh.)		Future Adj.(2025) ft. (veh.)	
		AM	PM	AM	PM	AM	PM
1. Western Roundabout							
<i>Northbound W. Frontage Rd</i>	4,300	20 (1)	341 (14)	53 (3)	<u>2173 (87)</u>	45 (2)	692 (28)
<i>Southbound I-80 off-ramp</i>	1,100	245 (10)	142 (6)	637 (26)	472 (19)	435 (18)	338 (14)
<i>Eastbound Gilman Street</i>	400	20 (1)	53 (3)	117 (5)	320 (13)	77 (4)	188 (8)
<i>Westbound Gilman Street</i>	190	60 (3)	72 (3)	92 (4)	108 (5)	92 (4)	110 (5)
2. Eastern Roundabout							
<i>Northbound I-80 off-ramp</i>	440	88 (4)	28 (2)	158 (7)	112 (5)	158 (7)	108 (5)
<i>Northbound Eastshore Hwy</i>	3,760	17 (1)	43 (2)	27 (2)	86 (4)	27 (2)	81 (4)
<i>Southbound Eastshore Hwy</i>	2,000	15 (1)	78 (4)	30 (2)	<u>1351 (55)</u>	30 (2)	719 (29)
<i>Eastbound Gilman Street</i>	190	53 (3)	124 (5)	71 (3)	194 (8)	71 (3)	174 (7)
<i>Westbound Gilman Street</i>	485 RRxng	35 (2)	160 (7)	60 (3)	714 (29)	60 (3)	446 (18)

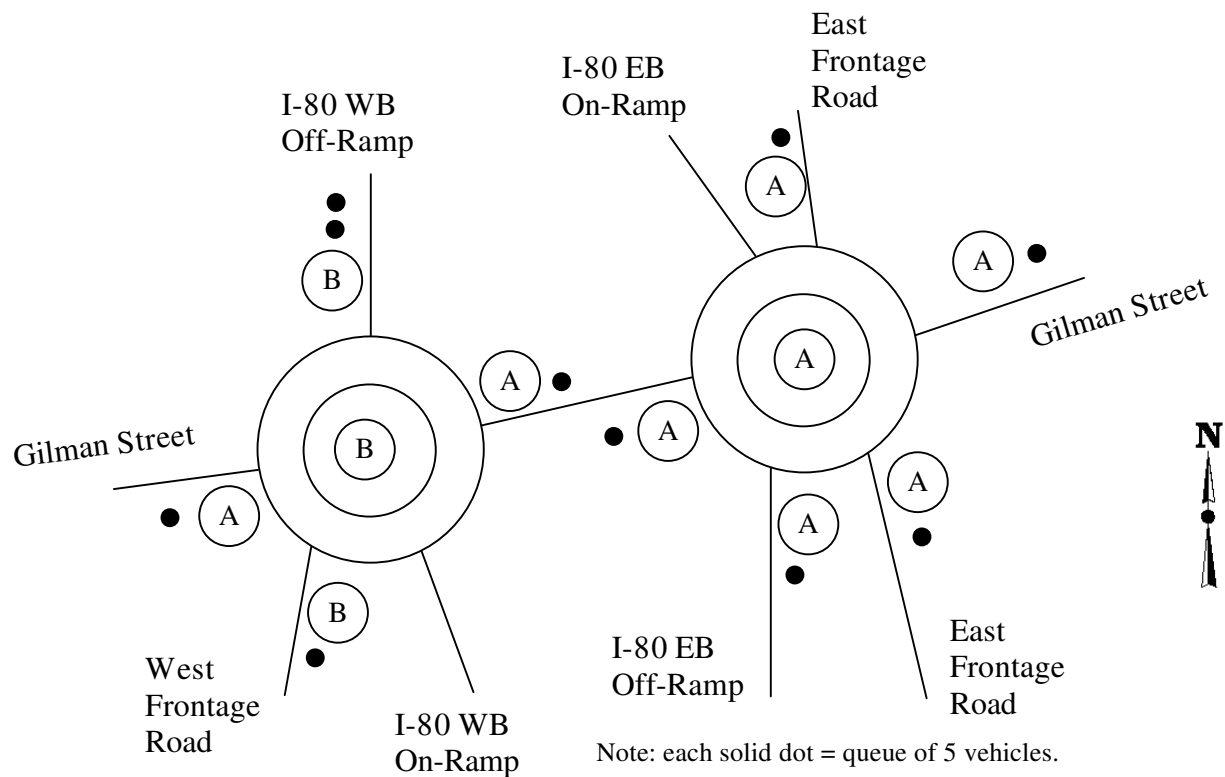
Notes:

Bold = queuing exceeds 80% avail. distance or 20 vehicles (500 ft.).

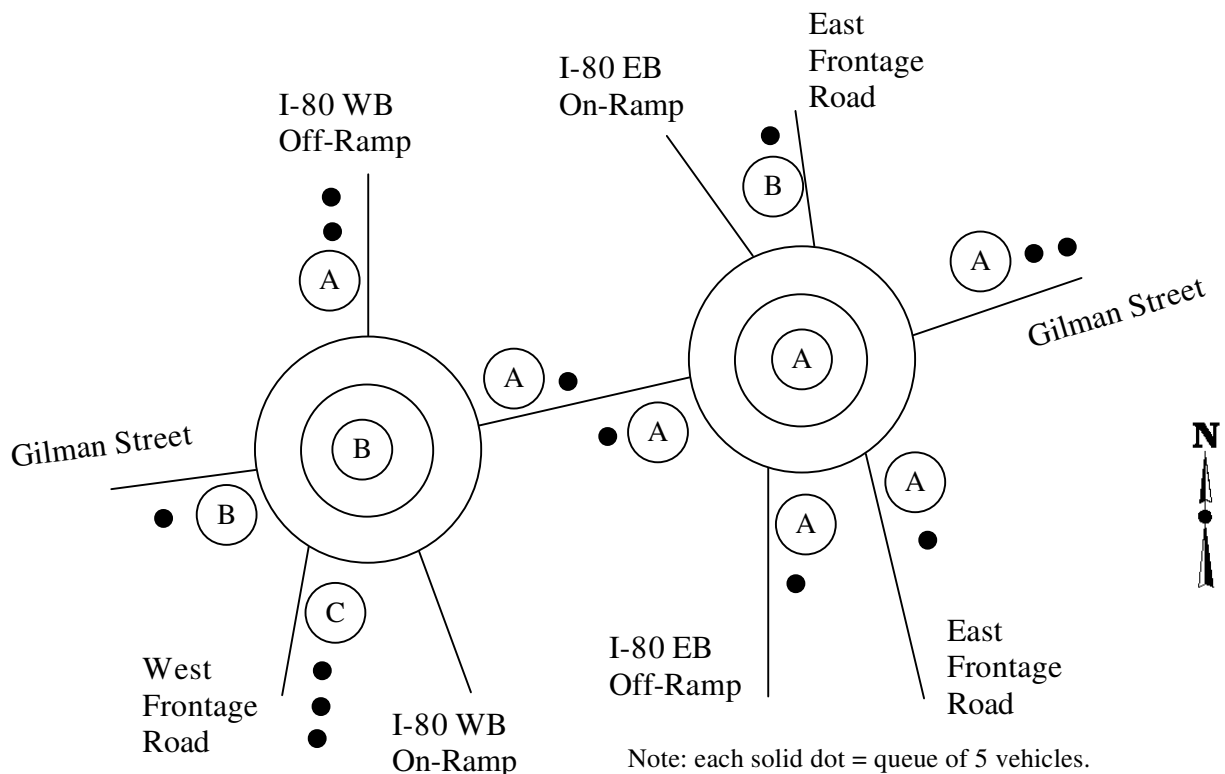
Bold and Underlined = queuing exceeds 100% avail. distance or 30 vehicles (750 ft.).

Future Adjusted = 2025 scenario with volume reductions to account for metering on northbound West Frontage Road at Gilman Street and southbound West Frontage Road at University Avenue.

Vehicle = average spacing of 25 ft.



AM Peak Hour



PM Peak Hour

Figure 6a. Level of Service & Queues for Existing Traffic Volumes

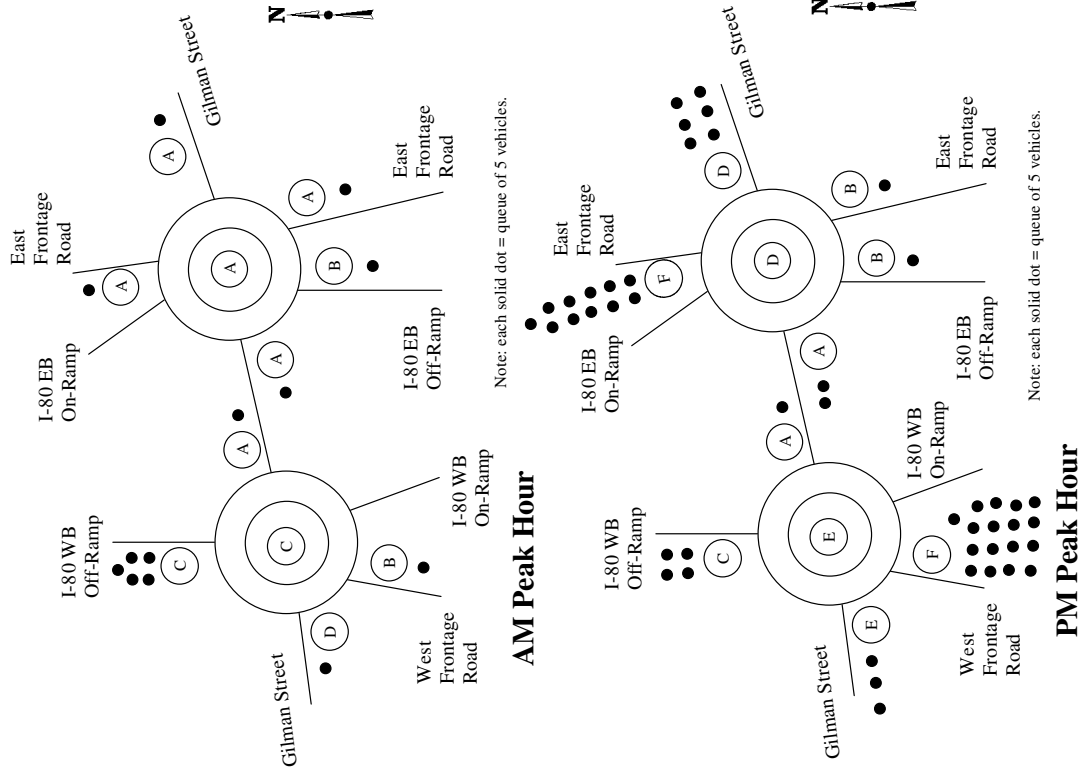


Figure 6b.
Level of Service for Year 2025 Traffic Volumes (Unadjusted)

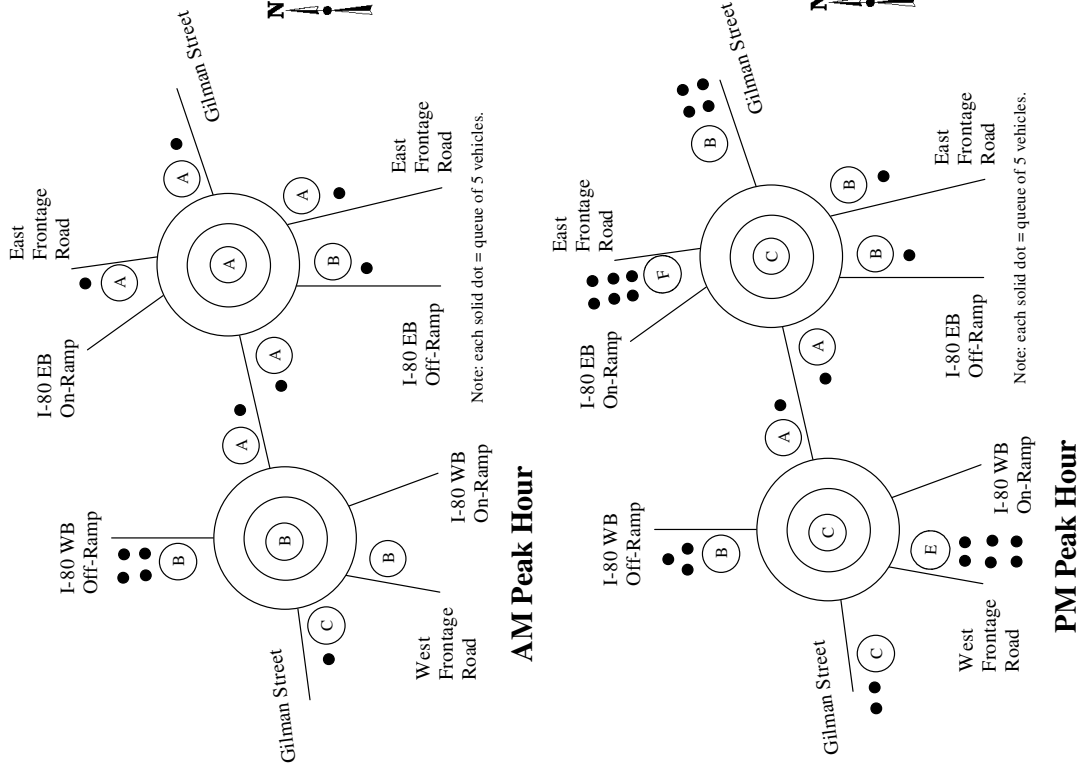


Figure 6c. Level of Service and Queues for Future
(2025) Adjusted Traffic Volumes

The significant difference between results for existing conditions and future (2025) conditions suggests that the installed roundabout can provide adequate capacity for a considerable period of time. This conclusion, however, might not be valid if the excess capacity of the improvement is filled up immediately with freeway bypass traffic. It is important that measures be considered to ensure that adequate capacity is available for traffic that does not both enter and leave the interchange area via freeway ramps.

The adjusted volume includes a 25% reduction in the two movements that contain a significant percentage of freeway bypass traffic, namely northbound West Frontage Road to I-80 eastbound on-ramp, and westbound I-80 off-ramp to southbound West Frontage Road. The reductions likely would result from the use of metering on the West Frontage Road's northbound approach and the southbound approach of the West Frontage Road at University Avenue, but drivers might on their own switch back to the freeway or other bypass routes as congestion increases on these approaches.

Metering strategies are considered a feasible approach to ensure that the interchange can adequately serve traffic that requires its use on its normal traffic route. The FHWA guidelines for roundabouts (page 214) authorize the installation of metered entrance points as long as they are needed to address unexpected demand that occur after installation. With the adjustments, the overall level of service for the roundabouts would be C or better, and the West Frontage Road's northbound approach would be LOS E in the PM peak hour. The southbound approach on the East Frontage Road in this time period would remain at LOS F but the queue would be reduced significantly from 55 to 29 vehicles. For this traffic, an alternative route exists via Buchanan Street. No approaches would have queues longer than 30 vehicles, and only two would have queues longer than 20 vehicles.

Alternative A-2 - One Oval Roundabout

Under this alternative, the east and west Gilman Street/I-80 and frontage road intersections would be transformed into one large oval roundabout. The intersection would serve movements to/from the I-80 westbound off-ramp, the I-80 westbound on-ramp, Gilman Street, Golden Gate Fields access, West Frontage Road, Bay Trail access, I-80 eastbound off-ramp, I-80 eastbound on-ramp, and Eastshore Highway approaches.

This alternative is shown in Figure 7 and consists of the following components:

- Dual circulating lanes are provided for three-quarters of the roundabout in order to serve the traffic demand.
- All approaches to the roundabouts would be single lane approaches except for the two I-80 off-ramps and the westbound Gilman Street approach, which are dual-lane approaches.



Not to Scale

Drawing by Alternative Street Design, P.A.



Gilman Street Interchange Improvements Figure 7 - Single Oval Roundabout (Alternative A-2)

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- The circulating roadway under the freeway would be located between the outer columns and the retaining wall. Significant grading would be required to locate the roadway at these locations.
- Pedestrian/bike paths would be created around the perimeter of the roundabout with standard roundabout pedestrian crossings at splitter island locations. The paths on the northern and southern sections would have to be provided between the roadway and the retaining wall.
- As shown in Figure 7, the single oval roundabout could be constructed within the existing Caltrans right-of-way with the exception of a small area near the Golden Gate Fields side access.

This option was dropped from further consideration before level of service calculations were performed. It would eliminate a merging point on each side of the interchange compared to the two roundabout alternative but would create long travel distances within the interchange for several movements to and from the frontage roads, as follows: southbound Eastshore Highway through and left turns, and northbound West Frontage Road left turn. Based on the additional volumes that would travel within each roundabout, it could be concluded qualitatively that the level of service would be worse than the two roundabout options. The single-oval design would also result in higher traffic speeds within the roundabout, thereby diminishing some of the safety benefits associated with roundabouts for both drivers and pedestrians.

Alternative B - Two Signalized Intersections

Traffic signals are routinely installed at diamond interchanges where each signal only has four legs. However, the existence of frontage roads on both sides of the interchange adjacent to ramps presents major operational difficulties for a signalized alternative. As the distance between the frontage road and ramp intersections on each side of the freeway is only 50 ft., movements at each set of two intersections would have to be operated by one signal. The need to accommodate all movements within a single cycle length significantly reduces the effectiveness of its operation, which in turn is likely to create queues between the two intersections in excess of the 200 ft. storage area. Coordination between the intersections on each side of the interchange was assumed in order to minimize queuing.

Figures 8a and 8b present the assumed lane geometry for the traffic signal option. Note that five lanes have been provided within the 60 ft. curb-to-curb distance for the section between the ramps so that a separate lane can be provided for the eastbound left turn movement together with two through lanes. The westbound left turn movement would also have a dedicated lane but with only one through lane. It was assumed that Gilman

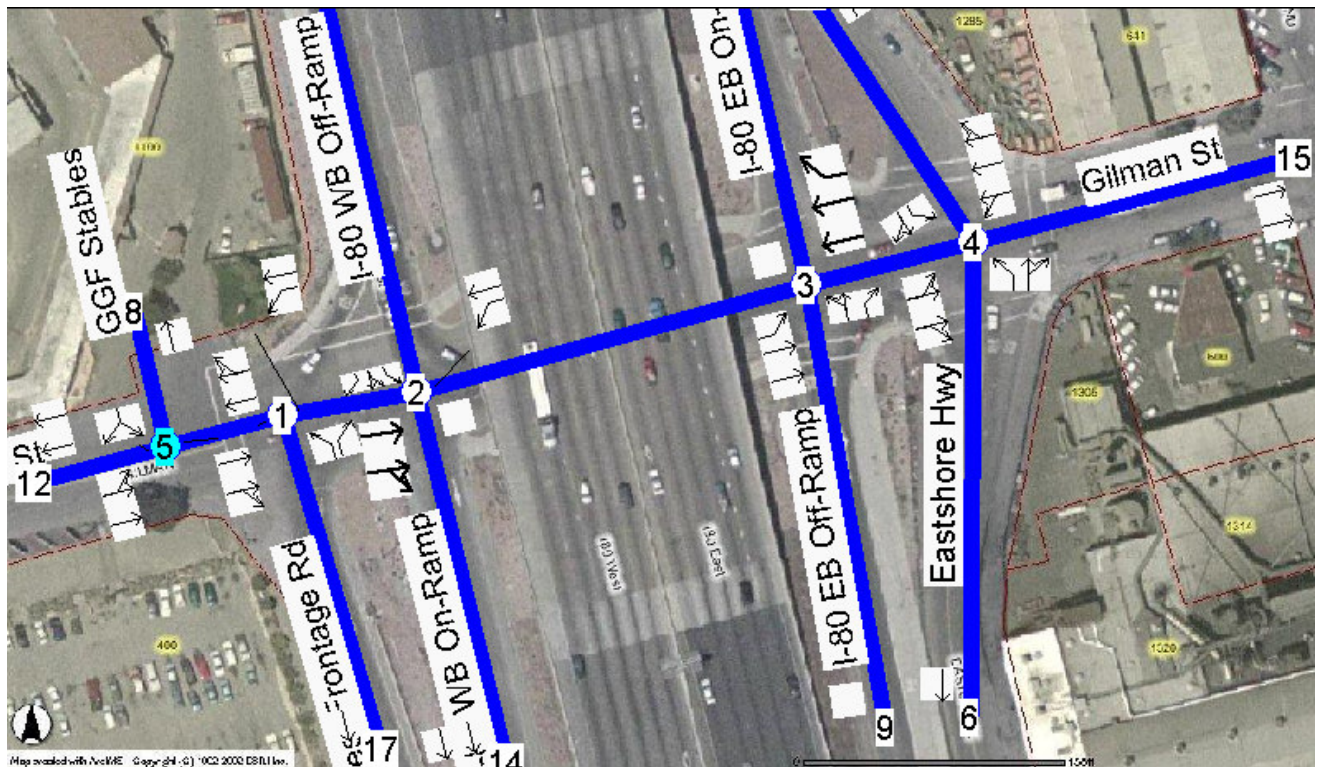


Figure 8a. Lane Configuration for Signalized Option (Intersections 1-4).

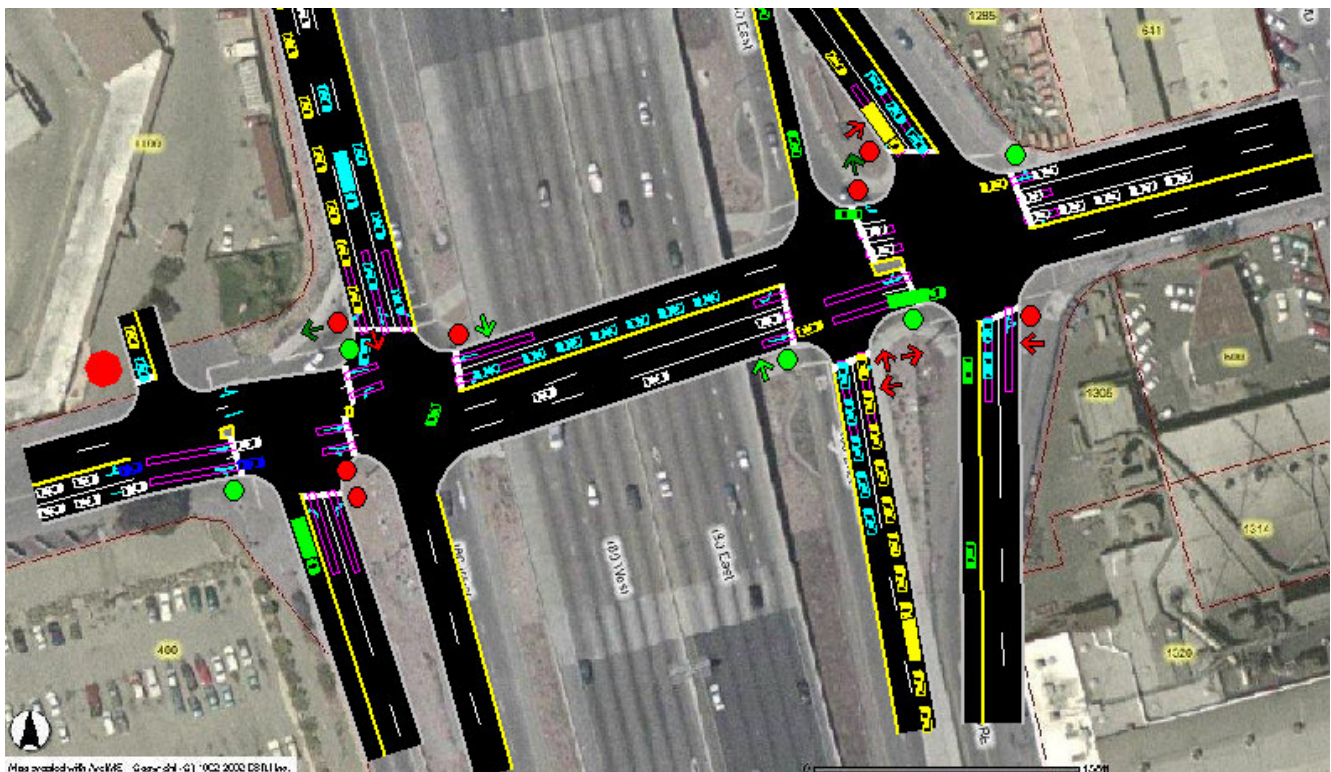


Figure 8b. Roadway Geometry for Signalized Option

Street to the east, Eastshore Highway and the West Frontage Road would all remain two-lane roads.

The operational analysis considers both level of service, as measured by average delay, which is presented in Table 9, and queue length, which is presented in Table 10. Synchro software was utilized for the analysis, as it is able to analyze complex intersections as well as estimate the impacts of queuing from adjacent intersections. The standard HCM analysis is only able to accurately analyze isolated intersections. Even for existing conditions, serious operational problems would occur. In the PM peak hour, the eastbound left turn would be at LOS F; and the queue, even with a dedicated lane between the signals, would exceed the available storage. In the AM peak hour, the westbound left turn would have an acceptable level of service but the queues would be excessive. Also, LOS F conditions would exist for two approaches to the interchange during the PM peak hour, namely the southbound left turn from the I-80 westbound off-ramp and the northbound left turn from the Eastshore Highway. For future conditions, the southbound left turn from the I-80 westbound off-ramp would be at LOS F during both the AM and PM peak hours.

The signalized intersection option is estimated to cost \$800,000. It could be constructed within the existing right-of-way and would require minimal changes in roadway geometry. However, based on the analysis, the traffic signal option would not provide acceptable operations even for existing conditions and, with increasing volumes for future years, operations would be even worse over time. The internal queues would increase and extending through the upstream intersection, which would reduce its capacity. Clearly, this option does not meet the objective of providing adequate capacity for the existing roadway alignments. Therefore, it had to be eliminated from consideration.

8. System and Regional Planning

The proposed project alternatives are anticipated to be consistent with statewide, regional and local planning efforts. The primary purpose of the alternatives is to improve intersection level of service and decrease collisions at the interchange. These goals are consistent with those of the City of Berkeley General Plan and Caltrans' Route Concept Report. A minor change in the General Plan will be required, as the Waterfront Plan, which was incorporated as part of the General Plan in 1986, still shows an alignment of the West Frontage Road next to the Bay shoreline, which would increase the feasibility of the traffic signal alternative. However, the approved plan for the ballfields and the City support of a roundabout alternative will require a minor update to the circulation element. It can be accomplished when the roundabout alternative is adopted by the City Council.

Table 9
LOS Conditions with Traffic Signals for Intersections and Selected Movements⁽¹⁾

Intersection and Selected Movements*	Existing (Avg. Delay-LOS)		Future (2025) (Avg. Delay-LOS)		Future Adj. (2025) (Avg. Delay-LOS)	
	AM	PM	AM	PM	AM	PM
1. Gilman St/West FrontageRd	16.7-B	21.7-C	32.5-C	73.1-E	22.3-C	32.9-C
Northbound Right	1.7-A	8.5-A	2.0-A	<u>105-F</u>	2.0-A	15.0-B
Westbound Left	16.0-B	11.6-B	33.4-C	67.0-E	19.4-B	31.5-C
Eastbound Through	45.6-D	6.7-A	68.5-E	68.4-E	60.0-E	68.3-E
2. Gilman St/I-80 WB Ramps	46.9-D	32.8-C	56.2-E	<u>90.1-F</u>	<u>70.2-E</u>	<u>98.4-F</u>
Southbound Left	69.7-E	<u>184-F</u>	<u>109-F</u>	<u>139-F</u>	<u>95.0-F</u>	<u>139-F</u>
Westbound Left	65.4-E	55.5-E	50.2-D	51.8-D	<u>104-F</u>	57.7-E
Westbound Through	35.4-D	38.8-D	62.9-E	<u>352-F</u>	51.7-D	<u>348-F</u>
3. Gilman St/I-80 EB Ramps	5.0-A	28.2-C	11.2-B	26.1-C	9.8-A	22.7-C
Eastbound Left	58.2-E	<u>211-F</u>	67.0-E	<u>90.1-F</u>	<u>81.1-F</u>	86.5-E
4. Gilman St/Eastshore Hwy	9.5-A	18.3-B	12.1-B	36.0-D	11.4-B	34.6-C
Northbound Left	66.3-E	<u>132-F</u>	78.3-E	74.9-E	59.1-E	74.9-E

Notes:

Delay = average seconds of delay per vehicle; LOS = Level of Service (A-F)

Levels of Service F are underlined.

(1) = Results are only shown for movements with significant traffic volumes and large delays. In many cases, large delays include impacts of downstream queuing.

Future Adjusted = 2025 scenario with volume reductions to account for metering on northbound West Frontage Road at Gilman Street and southbound West Frontage Road at University Avenue.

Table 10
Queue Lengths with Traffic Signals

Intersection <i>Approach</i>	Available Distance (ft.)	Existing ft. (veh.)		Future (2025) ft. (veh.)		Future Adj. (025) ft. (veh.)	
		AM	PM	AM	PM	AM	PM
1. Gilman St./West Frontage	-						
NB (West Frontage) Left	4,300	13 (1)	20 (1)	21 (1)	36 (2)	19 (1)	37 (2)
NB (West Frontage) Right	4,300	9 (1)	23 (1)	12 (1)	26 (2)	12 (1)	23 (1)
EB (Gilman) Through/Right	400	40 (2)	140 (6)	98 (4)	228 (10)	88 (4)	228 (10)
WB (Gilman) Left	200 ⁽¹⁾	<u>488 (20)</u>	181 (8)	<u>686 (28)</u>	<u>1147 (46)</u>	<u>481 (20)</u>	<u>872 (35)</u>
WB (Gilman) Through	200 ⁽¹⁾	5 (1)	11 (1)	13 (1)	19 (1)	12 (1)	13 (1)
2. Gilman St./I-80 WB Ramps	-						
SB (I-80 Offramp) Left	1,100	575 (23)	380 (16)	657 (27)	615 (25)	673 (27)	615 (25)
SB (I-80 Offramp) Thru/Right	1,100	611 (25)	403 (17)	696 (28)	654 (27)	717 (29)	654 (27)
EB (Gilman) Through/Right	400 ⁽¹⁾	10 (1)	77 (4)	35 (2)	113 (5)	29 (2)	75 (3)
WB (Gilman) Left	200	<u>330 (14)</u>	<u>225 (9)</u>	<u>405 (17)</u>	<u>293 (12)</u>	<u>354 (15)</u>	<u>292 (12)</u>
WB (Gilman) Through	200	110 (5)	<u>325 (13)</u>	174 (7)	<u>493 (20)</u>	186 (8)	<u>493 (20)</u>
3. Gilman St./I-80 EB Ramps	-						
NB (I-80 Offramp) Left	1,110	60 (3)	37 (2)	152 (7)	151 (7)	135 (6)	151 (7)
NB (I-80 Offramp) Right	1,100	34 (2)	24 (1)	23 (1)	27 (2)	18 (1)	24 (1)
EB (Gilman) Left	200	28 (2)	<u>262 (11)</u>	90 (4)	<u>396 (16)</u>	78 (4)	<u>311 (13)</u>
EB (Gilman) Through	200	7 (1)	102 (5)	34 (2)	104 (5)	10 (1)	104 (5)
WB (Gilman) Through	475 ⁽²⁾	118 (5)	174 (7)	125 (5)	216 (9)	106 (5)	204 (9)
WB (Gilman) Right	475 ⁽²⁾	8 (1)	340 (14)	5 (1)	<u>501 (21)</u>	0 (0)	<u>501 (21)</u>
4. Gilman St./Eastshore Hwy	-						
NB (Eastshore) Left	3,760	139 (6)	288 (12)	166 (7)	339 (14)	148 (6)	339 (14)
NB (Eastshore) Through/Right	3,760	43 (2)	61 (3)	49 (2)	81 (4)	47 (2)	81 (4)
SB (Eastshore) Left	2,000	44 (2)	46 (2)	82 (4)	132 (6)	75 (3)	132 (6)
SB (Eastshore) Through/Right	2,000	80 (4)	125 (5)	100 (4)	157 (7)	84 (4)	157 (7)
EB (Gilman) Approach	200 ⁽¹⁾	35 (2)	1 (1)	60 (3)	58 (3)	24 (1)	58 (3)
WB (Gilman) Approach	475 (RR xng)	73 (3)	205 (9)	107 (5)	279 (12)	121 (5)	279 (12)

Notes: Queue lengths are in feet and vehicles (assumes 25 ft. vehicle).

Bold and Underlined = 95th percentile queue exceeds available distance after two cycles, queue likely will be longer.

Future Adjusted = 2025 scenario with 25% volume reductions on northbound West Frontage Road at Gilman Street and southbound West Frontage Road at University Avenue to account for metering strategies.

(1) Since intersections 1 and 2 act as a single intersection as do 3 and 4, internal distances

(2) Distance from intersection eastward to at-grade, mainline railroad crossing ignored.

Vehicle = average spacing of 25 ft.

9. Selection of Preferred Alternative – Dual Roundabout

Based on the preceding operational analysis of options, the dual roundabout is the only alternative that meets the objectives of providing significant increases in capacity, improving traffic safety, and providing for safe and efficient movements for pedestrians, bicyclists, and public transit services. Below is a summary of the results for the options that were analyzed:

- No Build: The major stop-control approaches already operate at unacceptable levels of service, and problems with congestion and safety will clearly become worse with increased traffic volumes in the future. This option is unacceptable.
- Dual Roundabout: This option is the only one that provides acceptable operating conditions for existing conditions and likely for a considerable period into the future. In the future, if freeway bypass traffic is allowed to increase without constraints, it is possible that unacceptable congestion could exist on one or more entrance points.
- Oval Roundabout: This alternative does not perform as well as the dual roundabout as it results in increased volumes within each side of the roundabout.
- Signalized Intersections: The complex operation of the two signals that would be required and their close proximity would result in unacceptable levels of service and queuing for major movements, even with existing traffic levels. Congestion would only increase over time as traffic volumes increase in the future. This option is unacceptable.

10. Environmental Analysis

Environmental issues for this project are limited in scope. Below is a brief review of potential issues:

- Air Quality. The project does not create any additional roadway capacity on road segments entering or leaving the interchange area and, thus, will not generate any traffic beyond what has been forecast for the area. Also, roundabouts reduce stops compared to stop control approaches because they eliminate stops within the roundabout and provide yield control for all entering traffic.
- Construction Impacts: Demolition will be limited to removal of existing pavement, and the amount of material to be moved to or from the site will be relatively small. A traffic management plan will be prepared that minimizes

impacts on freeway traffic flows or on access to adjacent commercial or recreational activities.


- Archeological Evidence. The site is on a landfill that operated at the beginning of the 20th Century and has no known archeological remains.
- Toxic Materials. Virtually the entire project site has been paved, and the project will only disturb the top two feet of soil. Environmental studies were done when modifications to the overpass structures were made in the 1990's and mitigation measures undertaken at that time do not have to be repeated. After serving as a landfill, the area was part of the early industrial activity in the City of Berkeley. It is possible that there are toxic plumes in the soil that could take toxic substances into storm drains during the wet season. Clay is the predominant soil type in the area, which causes plumes to migrate along existing trenches and pipelines. Where an unpaved surface is disturbed, the soil will be removed and replaced with appropriate fill during construction.

11. Right-of-Way Acquisition

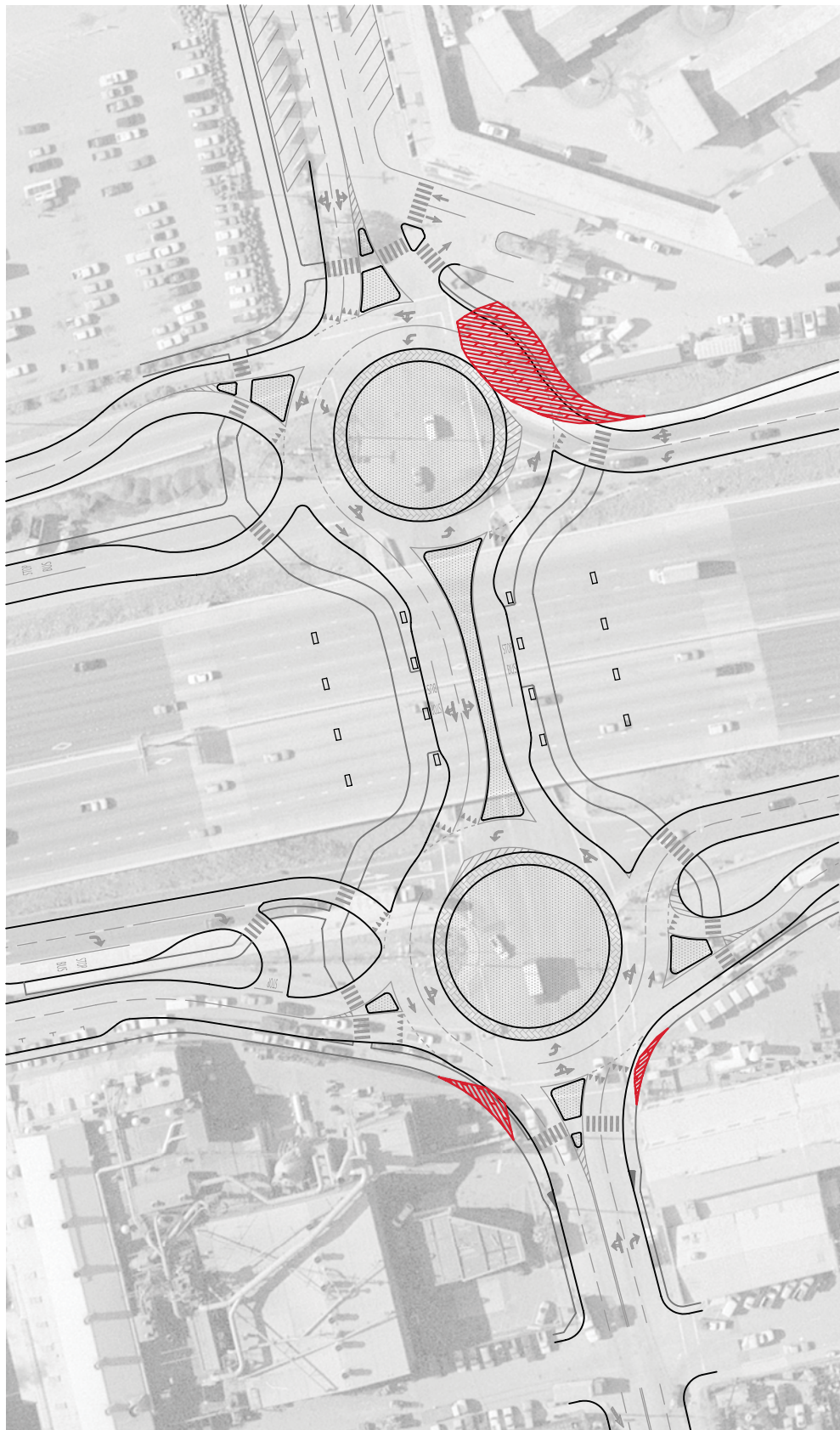
Roundabout installations, because they include a circular travel pattern within the intersection that must accommodate trucks, often require right-of-way acquisitions. In this case, acquisitions are limited because the proximity of the frontage roads to the ramps has already created a large area where the roundabouts will be located. Also, to the extent possible during conceptual design, the design has been refined to minimize any possible right-of-way takes while retaining the required number of travel lanes within the roundabout and at entry and exit points.

Figure 9 presents the estimated right-of-way acquisitions based on the preliminary design, and Table 11 contains the estimate or estimated right-of-way takes. No right-of-way take is shown for the southwest corner. In this area, the City is responsible for the development of the ballfields project on land purchased by the East Bay Regional Parks District, and it was possible to accommodate the roundabout without affecting the overall design of the ballfield project. An easement will be obtained where an overlap occurs. Right-of-way acquisitions for the eastern roundabout are minimal, with each quadrant requiring less than 400 sq. ft. Neither of these acquisitions affects building structures and should not diminish the value of the business on the affected parcel. On the northwest corner, the land acquisition is limited to landscaping in front of the entrance to the stables. It is likely that a trade-off can be made in regards to improvements adjacent to the project that would benefit Golden Gate Fields. In any case, the right-of-way in this quadrant will not affect operations at Golden Gate Fields.

Based on an estimate of \$30/sq. ft., which is an average of recent purchases of non-residential land in West Berkeley without structures, the right-of-way acquisition costs

 approximate
right-of-way needed


North
not to scale
October 2005



Gilman Street Interchange Improvements

Figure 9 - Estimated Right-of-Way Acquisition for Dual Roundabout Alternative

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have been rounded to \$110,000. The actual right-of-way requirements and costs will be refined in the next phase of the project.

Table 11
Preliminary Right-of-Way Acquisition Requirements

Interchange Quadrant	Current Use	Area (sq.ft.)	Est. Cost/ sq. ft.	Estimated Cost
Northeast Corner	Light Industrial Parking	170	\$30	\$5,100
Southeast Corner	Light Industrial Parking	380	\$30	\$11,400
Southwest Corner	Recreation - Public Ballfields	0	\$0	\$0
Northwest Corner	Horse racetrack with betting - Golden Gate Fields	3,450	\$30	\$103,500
Totals		4,000		\$120,000

12. Landscaping

The City of Berkeley is interested in having the dual roundabout project include a pleasing setting for persons passing through the area. For the roundabouts, the intention will be to provide landscaping within the paved area of the roundabout. No decision has been made at this time whether it will focus on grass or low-lying, drought-resistant plantings. At this time, the intent would be for maintenance to be provided by the City of Berkeley. It is not expected that any landscaping will be required at other locations within the project site. Treatments underneath the overpass will be limited because of the absence of sunlight for growing plants and will focus on providing adequate lighting for pedestrians, bicyclists, and transit riders. Appropriate street furniture will be included.

For cost estimating purposes, landscaping costs have been estimated at \$25,000. The option exists to pursue Transportation Enhancement funds if this amount is unavailable or inadequate at the time of construction.

13. Funding/Scheduling

The overall project is estimated to cost \$1.5 million. The breakdown of costs is presented in Table 12. Once the preferred option is approved by Caltrans, the first task will be to prepare a more detailed construction estimate. Although the actual construction activities for the project are relatively simple, traffic control to minimize travel delays will be a critical cost element.

Table 12
Estimated Costs of Dual Roundabout Alternative

<u>Cost Element</u>	<u>Estimated Cost</u>
Construction	\$1,225,000
Structures Construction	\$0
Design (10%)	\$122,500
Plans, Specs, & Estimate	\$97,500
Traffic Mgmt. Plan	\$25,000
Right-of-Way Acquisition	\$120,000
Environmental	\$14,500
Landscaping	\$18,000
Total Estimated Cost:	\$1,500,000

Federal funding of \$1.2 million was included as a set-aside project in the 2005 Reauthorization of the Federal Transportation Bill. With the required 20% match, the \$1.5 million initial project estimate can be reached. The City of Berkeley already has an available local match of \$60,000, which will be adequate to fund the design phase. The additional local match funds of \$240,000 will be sought from Alameda County and State sources, as the project serves a freeway interchange. Also, any development projects that are proposed will be required to pay a fair share of the remaining local share. Given the small amount of remaining additional funds, it is almost a certainty that they can be obtained by the time that construction begins.

The estimated schedule of activities leading to completion of the project is shown in Table 13. Based on this schedule, construction would begin in the summer of 2008 and be finished by the end of the year. It is possible that construction could begin even earlier if the estimated construction-only cost is below \$1,000,000.

Table 13

			2005												2006												2007												2008											
			O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D									
Task	Start Date	End Date	Weeks																																															
1 Submit PSR to Caltrans	11/1/2005	11/1/2005	0																																															
2 Submit Design to Caltrans	11/1/2005	11/1/2005	0																																															
3 Caltrans Review of PSR	11/1/2005	5/31/2006	30																																															
4 Caltrans Geometric Review	11/1/2005	2/28/2006	17																																															
5 Project Included in FTIP	2/1/2006	2/1/2006	0																																															
6 Federal \$ Released:	4/1/2006	4/1/2006	0																																															
	60%	11/1/2006	0																																															
	80%	11/1/2007	0																																															
	100%	11/1/2008	0																																															
7 Prepare PR	6/1/2006	8/31/2006	13																																															
8 Caltrans Review of PR	9/1/2006	11/30/2006	13																																															
9 Advertise for Consultant	1/1/2007	1/1/2007	0																																															
10 Select Design Consultant	3/1/2007	3/1/2007	0																																															
11 Prepare Environmental Documentation	4/1/2007	6/30/2007	13																																															
12 Caltrans Review of Environmental Documentation	7/1/2007	9/30/2007	13																																															
13 Final Design (PS&E)	5/1/2007	11/30/2007	30																																															
14 Caltrans Review of Design	12/1/2007	2/29/2008	13																																															
15 Project Bid	4/1/2008	5/1/2008	4																																															
16 Project Construction	8/1/2008	12/31/2008	22																																															

14. Programming Recommendation

As most of the funding has already been secured, the project can move into the Regional Transportation Improvement Program and can move into more detailed analysis of right-of-way and environmental issues and as soon as the PSR is approved.

15. Caltrans District 4 Contacts

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